TRACHOMA

AND ITS

CLINICAL MANIFESTATIONS

IN NORTH INDIA.

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C O N T E N T S.

1. INTRODUCTION.

Trachoma is a subject of great importance in India at the present time. The following thesis is based on many cases seen during 5½ years' (1909-1914) medical work in the New Zealand Mission Hospital, Jagadhri, Punjab. Every day, in the Out-Patient Department, there was the opportunity of seeing a wealth of clinical material. During the year June 1913-June 1914, 27540 new out-patients received treatment at the above hospital. Of this number, 4226 were suffering from eye disease, and of these, 2550 were diagnosed as suffering from Trachoma. On account of the great rush of work, it was impossible to preserve notes of all cases seen. Detailed notes of 50 representative cases were made on a specially printed form. A larger number of these were to have been written up, but the outbreak of war and leaving India to join the Army Medical Service prevented this. However, these case-sheets, along with many and various notes and investigations, are sufficiently typical to enable me to work up and develop the subject. The 50 cases are tabulated at the end.

So much has been written about Trachoma, and the subject has been so much discussed in the past, that until the causative organism is definitely discovered, it might seem as if it were unnecessary to write anything further on the matter. In Great Britain(where Trachoma is non-existent,except as an alien disease) this is probably true; but in India and in Egypt this is not the case. In these countries, Trachoma causes, at the present day, an inconceivable amount of suffering, and

its results cause so much disabling of the population, that not only to the Medical Profession, but to the British Government, the disease presents one of the greatest problems.

The present war has brought all parts of the British Empire into contact, and will result in two things:-

1. A greater coming and going amongst the different peoples of the Empire.
2. An increased sense of responsibility for the bettering of the condition of the poorer races.

In Egypt, chiefly through the work of MacCallan, a great deal has been done by the Government to fight this plague. The burden of the responsibility of educating the people of India in preventive measures against Trachoma lies, in the first place, with the medical profession. In India, up to the present time, no plan of campaign adequate to combat this widespread disease has been organised.

2. DEFINITION.

Trachoma is a chronic form of Conjunctivitis, caused by a specific contagion, which, in the earlier stages, is characterised by the presence of typical follicles or granulations, and in the later stages by typical scarring of the conjunctiva, and which, if untreated, may result in deformity of the eyelids and permanent interference with vision.

3. SHORT HISTORY OF TRACHOMA, with special reference to its relationship with "Egyptian Ophthalmia."

For the purpose of consideration, the History of Trachoma falls into two well-defined periods:-

(1) Up to the closing years of the 18th. Century.

(2) From then up to the present time.

(1) The study of the history of Trachoma in early times is very complicated. The chief reason for this is, that, from the records, it is impossible to differentiate clearly the disease from other forms of epidemic ophthalmia.

The oldest record of the disease is that of the Ebers papyrus, which was discovered by George Ebers in the year 1872. This book was written during the height of Egyptian civilization, about 3500 years ago. Boldt[1] describes it as "a compilation containing only prescriptions for various diseases, including those of the eye - - - - - On translating this highly important discovery, Ebers proved that the Egyptians recognised the condition of "blear eye" or watery eye; and Hirschberg is of opinion that the expression means eye affection with considerable secretion, especially the sequelae of Chronic Granular Conjunctivitis." It may also be assumed from the record that, though eye disease was prevalent in Egypt at that time, it was not so generalised throughout the country as it is at the present day, when,

[1] Boldt, Trachoma (Trans Parsons) London 1904 p.2.

according to MacCallan,[1] 95% of the population are affected with Trachoma. The ancient literature of the country does not in any way indicate that Trachoma existed in any such pandemic form. It is probable, therefore, that, as civilization in Egypt declined, and as the social conditions of the people became worse, Trachoma obtained a firmer footing, and became more widespread. It has often been taken for granted that the birth-place of Trachoma was in the Nile valley in Egypt, but, though definite proof is impossible, there is nothing to shew that the disease did not exist in other Eastern countries from early times. Where conditions similar to those of Egypt prevailed, conditions of poverty, overcrowding and lack of sanitation, it is difficult to imagine that the disease which has such a firm hold in Palestine, Arabia, India and China today, could have been absent in early times.

References in Greek Literature.

In ancient Greek literature there are numerous accounts of severe and contagious ophthalmia. Hippocrates, about 420 B.C., describes trikōsis or trichiasis of the eye lids. A treatise of about the same date, peri ophios mentions the treatment of Trachoma by friction. Plato (427-348 B.C.) speaks of sensations for which it is impossible to find an external cause, affecting us in the same manner as ophthalmia caught from other people." Plutarch, Ovid and Seneca also remark on contagious forms of ophthalmia.[2]

1 Mac Callan, Trachoma & its Complications in Egypt. London. 1913, p. 2.

2 Boldr, loc. cit. p. 6.

Amongst the Romans. Celsus,[1] about the time of Christ, gives a good description of the roughness of the inner membrane of the lids which he calls "aspritudo". "In his principal work, 'De Medicina', he writes:- 'Haec autem (aspritudo) inflammationem oculorum fere sequitur, interdum major, interdum levior. Nonnunquam etiam ex aspritudine lippitudo fit; ipsa deinde aspritudinem auget, fitque ea in aliis brevis, in aliis longa, et quae vix unquam finiatur.'"

About 600-640 A.D., Paulus Aegineta,[2] a Byzantine Greek who lived at Alexandria, in a chapter peri trachomatos distinguishes fresh cases as sukosis or fig disease, where the conjunctiva is like the surface of a cut fig, and chronic cicatricial cases as tulosis or callosity. He describes an instrument for scraping the lid, and mentions trichiasis and the operation for its treatment still in common use in Egypt.

In the Middle Ages, many of the Arabian surgeons describe trichiasis and pannus, and operations such as scraping the lids etc.. Their descriptions of the disease are lengthy and confusing. Amongst European writers in the Middle Ages, there are none who have added anything to our knowledge of Trachoma. Their descriptions are so vague that they give no information.

From the Middle Ages up to the end of the 18th. Century, Trachoma seems to have attracted little attention in Europe, and there are no works of any scientific interest on the subject. This is partly due to the fact that the treatment of diseases of the eye to a large extent had fallen into the hands of so-called oculists, who were little more than quacks.

1. Celsus, "De medicinia" VI. vi. 26 Quoted by Bolder, loc. cit. p.6.
2. Paulus Aegineta, Quoted by MacCallan, loc. cit. p.1.

2. We now come to the second period in the history of Trachoma, which dates from the time of the Napoleonic campaign in Egypt. Amongst the French and British troops engaged in those campaigns, there occurred alarming epidemics of acute eye disease, which,on their return, they disseminated not only in the garrison towns of Southern Europe and England, in which they were quartered, but also amongst the civil population of their native countries. This disease at the time was commonly styled "Egyptian Ophthalmia". It has been described at great length by a number of writers, chiefly Army Surgeons, in the early part of the 19th. Century. In discussing the history of this epidemic, it will be interesting, in the light of our present-day knowledge of ophthalmia, to attempt to discover if this disease were Trachoma, and if not, what relationship Trachoma had to it.

But,first of all, let us enquire briefly into the history of the onset of Egyptian ophthalmia and its spread.

Napoleon landed in Egypt on July 1st.1798, with an army of 35000 men. "On July 22nd. his victorious troops were opposed by a far more dangerous foe than they had yet encountered - disease."[1] His troops were attacked with great losses by many of the diseases common to tropical countries, "but Trachoma, the Egyptian ophthalmia, was especially fatal to their efficiency as a fighting force."[1] The disease spread with alarming rapidity through the Army, and the same year the French were obliged to open special eye hospitals and to invalid home a number of

[1] Boldt, loc. cit. p.9.

blind. Larrey, the French surgeon, in his "Memoirs"[1], gives an account of the disease, with its results, and claims great success in the treatment of it. According to him, in the later months of 1798 almost all the French troops suffered from it, though in a comparatively mild form. During the two following years, when the Army had gone inland, and had not to undergo such hardships and privations, nor endure long desert marches, the epidemic almost disappeared. In the spring of 1801, however, when the French Army returned to the coast region to attack the British, the disease again began to spread, until two-thirds of the French troops were affected. It is evident that, though a number of French soldiers lost their sight (1000 men, according to Sir James McGregor)[2], in a large proportion of cases the disease was mild in character, lasting for a short time only, and not leaving any after-effects.

In 1800 the British troops landed in Egypt, and "were almost all attacked by Trachoma".[3]

There is no doubt that with the return of the French and British troops to Europe the disease was spread broadcast. In the literature of the time there are many interesting accounts showing, that wherever these troops touched or were garrisoned, ophthalmia broke out and spread with greater or less severity, not only in the Army, but amongst the civil population.

The following extracts are amongst the most interesting, and give

1 Larrey, Mémoires, Quoted by Boldt loc. cit. p.10
2. Sir James Mac Gregor, Medical Sketches London, 1804 p. 147
3 Boldt, loc. cit. p.11.

ample proof of the above statement.

John Vetch[1] gives us in detail the history of the formation of the 2nd. Battalion of the 52nd. Regiment of Light Infantry in 1804. Soon after its formation, the Battalion was moved to Hythe, where it was joined by 500 Irish volunteers. It was discovered afterwards that many of the Irish recruits had volunteered from regiments in which the disease had prevailed, and some of them had themselves been infected in a mild form. In July of the following year, the first case of ophthalmia appeared in the battalion. Soon after, it spread rapidly, and with disastrous results. "The total strength of the 2nd. battalion of the 52nd. from which the description of the disease has been taken was somewhere about 700 men. 636 cases of ophthalmia, including relapses, were admitted into the hospital from Aug.1805, when the disease commenced, till the same month in 1806. Of these, 50 were dismissed with the loss of both eyes, and 40 with that of one. It did not appear to be decidedly more violent in any one of the slighter shades of temperament than another, and either eye seemed equally liable to experience the violence of the disease."

MacGregor[2] writes:- "It is a melancholy fact, as appears by the returns of Chelsea and Kilmarnham hospitals, that 2317 soldiers were on the 1st. Dec.1810 a burden upon the public from blindness in consequence of ophthalmia."

1 Vetch, Account of the Ophthalmia which appeared in England since the return of the British Army from Egypt. London 1807. p. 2-9.

2. Mac Gregor Patrick, Quoted by Collins in Boldt. loc. cit. introduction p. XV.

Ophthalmia so spread in a number of regiments that for a time they were unfit for service, and, though those which had been in Egypt were the worst affected, still, as in the case of the 52nd. Regt., it prevailed extensively in some that had never been in that country. The disease does not seem to have been so severe in women and children as amongst the troops. MacGregor,[1] after explaining that it is the same disease that affected the troops, states:- "Its consequences have not been so injurious to children as to adults; for out of the great number of children that have been afflicted with the disease at the Military Asylum, only six have lost the sight of both eyes and twelve the sight of one eye."

M. Guillié[2] gives a very interesting account of an outbreak of ophthalmia in the French slave ship "Rodeur", which left Havre with a crew of 22 on Jan.24th. 1819 for the West Coast of Africa. She took on board 160 negro slaves, who were crowded together in the hold. Shortly after sailing, it was noticed that the slaves " had contracted a considerable redness of the eyes, which spread with rapidity from one to the other." The crew did not become alarmed until they themselves began to be attacked. "The first man of the crew attacked was a sailor. - - - - Next day a lad was affected with the ophthalmia; and in the course of the next three days, the Captain, and almost all the crew, were seized." The disease commenced with an itching in the margin of the eyelids, which became red and swollen. Next day the swelling increased and the eyes

1 Mac Gregor Patrick, On account of an Ophthalmia in the Royal Military Asylum in 1804. Quoted by Middlemore, Diseases of the Eye, Vol I London 1835 p. 49.

2. M. Guillié, Bibliothèque Ophthalmologique, p. 74. Quoted by Middlemore, loc. cit. p. 106

were painful. On the third day a discharge of yellowish matter commenced, at first thin, but soon becoming viscid. It was with great difficulty that the crew was able to manage the ship, and on the 21st. of June the ship reached Guadaloupe in a deplorable state. "Of the negroes, 39 remained totally blind, 12 lost each an eye, and 14 had specks, more or less considerable, of the cornea. Of the crew, 12 men lost their sight; one of these was the surgeon. Five lost each one eye, and amongst these was the captain."

These extracts from the literature of the time are sufficient to show how widespread, and in some cases how disastrous, this epidemic of eye disease was.

Let us now try and answer the question, What really was Egyptian Ophthalmia?

From the works quoted, one thing stands out clearly as regards this epidemic, namely, that it varied greatly in severity from time to time. In the first place, many of the cases were evidently of a very mild nature, and cleared up absolutely without leaving any trace of the disease in the conjunctiva. Take, for example, the outbreak in the French Army in the spring of 1801 in Egypt. Out of 3000 troops attacked, according to Larrey,[1] "il n'y en a pas un seul qui ait perdu la vue." It is well known at the present day, that in the springtime of the year, with the onset of the hot weather, not only in Egypt, but in all Eastern countries, epidemics of catarrhal conjunctivitis are

1. Larrey, Mémoires, Quoted by Taylor, in Trachoma, A Chapter in Military Medicine. Indian Medical Gazette. Vol XLVIII. 1913. p.120

very common. This disease is usually caused by the Koch-Weeks bacillus, it is very contagious, and would spread very rapidly amongst troops crowded together and not realizing the contagious nature of the epidemic. There is no doubt, therefore, that many of the milder cases of Egyptian Ophthalmia were cases of Catarrhal Conjunctivitis, and had nothing to do with Trachoma. On the other hand, it is quite clear that many of the severer cases were due to Gonorrhoeal Conjunctivitis or Acute Blennorrhoea." The red, hot, and oedematous lids at the onset, the great swelling of the palpebral conjunctiva with chemosis of the bulbar conjunctiva, the nature of the discharge, at first thin and pale, becoming abundant, viscid and yellow, and sometimes amounting, according to Vetch, to several ounces a day, and above all the rapid involvement of the cornea, and in many cases its total destruction - all these have been described as the typical symptoms of Egyptian Ophthalmia. We know of no other disease occurring in epidemic form and corresponding to the above symptoms, except Gonorrhoeal Conjunctivitis, and moreover we know that venereal disease was very common amongst the troops in those days.

What part did Trachoma play in the epidemic? Do the conclusions we have come to, that large numbers of the cases of "Egyptian Ophthalmia" were in reality cases of gonorrhoeal or catarrhal conjunctivitis, exclude Trachoma? Taylor[1], in an article "Trachoma, a chapter in Military Medicine", discussing this subject, states:- "The most obvious

1. Taylor loc. cit.

feature of Trachoma is the 'granulations' on the mucous surface of the lids, and one seeks in vain for any mention of these."

Vetch in 1807, and later MacKenzie in 1830, seem to be the only ones who have described this symptom; in fact Vetch is the first one to use the term "granulations", though his description of them is not altogether accurate. Vetch also describes pannus, which was occasionally seen. In the second figure of the plate of his "Account"[1], he gives an accurate picture of pannus trachomatosus, which is altogether different from the corneal complications of gonorrhoeal ophthalmia. Again, he writes[2]: "Long after the eye seems to have recovered its natural and healthy appearance, the complaint nevertheless exists, and is liable at all times to a renewal of its infective quality." MacKenzie[3] also recognises the persistence of a chronic condition after acute attacks. "In many cases, and especially in those who have suffered repeated relapses, the symptoms which are the latest to disappear are the enlarged and indurated state of the mucous cryptae of the conjunctiva of the eyelids - - - - - and the vascular and nebulous state of the cornea. - - - - The state of the conjunctiva has generally received the name of Granular Conjunctiva." Harman[4] sums up the discussion in the following words:- "We come to a stage when, under certain conditions, the disease assumed a chronic form, characterised by a rough, indurated conjunctiva and a vascular cornea." We have sufficient proof, therefore, in the granulations, the pannus, and the

1. Vetch, loc. cit. Plate I.
2. Vetch, A Practical Treatise on the Diseases of the Eye. London. 1820. p. 185.
3. MacKenzie, Diseases of the Eye, London, 1830. p. 347.
4. Harman, The Conjunctiva in Health and Disease. London 1905. p. 157

chronic course of the disease to state definitely that Trachoma played a considerable part in Egyptian Ophthalmia and in the numerous outbreaks that occurred from time to time in the early part of the last century.

It is to the credit of the Army Surgeons, especially of Great Britain, that Trachoma is now practically non-existent in the Army, even in those countries where the disease is common amongst the civil population. In the year 1902 there were no admissions for Trachoma in the British Army in India. Treacher Collins[1] states that "Trachoma was practically unknown amongst our troops during the late South African War."

Trachoma and the Present War.

During the present war, I acted as Medical Officer for a Battalion of the London Regiment in England, France and Salonica. We were continually being reinforced by drafts from various places. During one year, though there were a few cases with catarrhal conjunctivitis, there was not a single case of Trachoma. I have also made numerous investigations and have enquired from a large number of Medical Officers, especially those of the New Zealand Medical Corps who did service with the troops in Egypt and Gallipoli. They all admit that Trachoma was very prevalent amongst the native population of Egypt; but with the exception of one Medical Officer, an eye specialist, none of them had seen a single case amongst our white troops, and he had seen only one. This is further proved by the Report of Lieut. Col. Eason[2]:- "The cases of recent Trachoma have been rare and only sporadic, and there has been nowhere any-

1. Bolat. loc. cit. introduction. p. XX

2. Lt. Col. Eason. R.A.M.C., Report on Ophthalmic Cases in Cairo and Alexandria, Jan - June 1916. British Journal of Ophthalmology. Vol I. Aug. 1917.

where anything approaching even a local epidemic. Only 28 cases out of a total 5810 ophthalmic cases amongst British and Indian troops were diagnosed as Trachoma." When we compare this with the state of things that existed in the Armies in Egypt in the time of Napoleon, we realize how remarkable a victory has been won over Trachoma in our Army by the Officers of the Army Medical Service. That this state of things does not exist in the Armies of all European countries may be gathered from a perusal of Boldt's "Trachoma" (Chapters 1 and 2).

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again the advice of experts was sought as to the best means of stamping out the disease."

In 1888 Stephenson was appointed Ophthalmic Surgeon to the school. "In 1889 the proportion of inmates at the Hanwell school afflicted with ophthalmia was about 33%." A large sum of money was spent in erecting a building suitable for isolation, and in 1895 only 0.5% of the pupils were infected.

Similar measures were adopted in the other Poor Law Schools, and the second great breeding ground of Trachoma, from which epidemics could spread to the population, was destroyed.

There exists in Great Britain at the present time another great source of supply of Trachoma, and little has been done to eradicate it, Trachoma in this country today is largely an alien disease, occurring chiefly amongst Poles, Armenians and other foreigners from the Near East. It is probable that after the war there may be a considerable influx of such peoples into England, and unless measures are taken to prevent trachomatous people from being admitted, it is not at all improbable that we shall hear of outbreaks of this disease in the crowded areas of our large cities.

Treacher Collins[1] shows how, in late years, England has acted as a filtering bed for immigrants for America suffering from Trachoma. Many such Eastern immigrants travel by way of English ports, and the Shipping

1. Bolder, loc. cit. introduction p. XXXIV – XXXVI

Companies, knowing that aliens infected with Trachoma are prohibited from landing in America, refuse to embark them, or if by mistake they do, they are forced to return them, and in either case they are dumped in England. The Authorities of this country have still to be awakened to the fact that Trachoma is a dangerous contagious disease. Something more than is suggested in the following finding of a recent Report of the Commission on Alien Immigration,[1] "the desirability of permitting people suffering from this contagious disease to come into the country has to be considered", will have to be done before we can look upon the country as free from the risk of further outbreaks of Trachoma.

In parts of Ireland Trachoma still exists to a considerable extent. The proportion of trachomatous cases to other eye patients is higher in Dublin than in any large English or Scottish town.[2]

In some parts of Australia, especially in the arid districts where there is no rain for the greater part of the year, Trachoma is a common disease. Here also it has been confused with a mucopurulent form of ophthalmia, known to all people in South and West Australia as "Sandyblight." In these districts "Sandyblight" is epidemic during the hot summer months, when the glare of the sun, the sand, and the dust combine to irritate the conjunctiva and predispose it to be attacked by organisms, such as the Koch-Weeks bacillus. There is no doubt that

1. Bolton, loc. cit. p. xxxvi
2. " " " p. xxxviii

the pathological condition of the conjunctiva produced in this way, in its turn, prepares the way for Trachoma. We are not surprised, therefore, that in these parts, even though the population is sparse and the people live in comfortable homes, Trachoma is more common than in crowded towns like Sydney or Melbourne, where such climatic conditions do not exist.

In New Zealand, Trachoma is rare, and is usually seen in immigrants. Of the few cases seen by me at the Hopsital of the New Zealand Medical School at Dunedin, practically all had caught the disease in Australia. Maoris are not immune, though it is rarely seen amongst them in New Zealand. In October 1917, a Maori of the New Zealand Expeditionary Force was undergoing treatment for Trachoma in No.2 New Zealand General Hospital, Walton, Surrey. He had contracted the disease in Egypt.

In Canada, Trachoma occurs chiefly amongst immigrants from Poland and the Near East, and is commonest in Quebec and Montreal.[1] In 1902 the Canadian House of Commons amended the Immigration Act in such a way as "to prohibit the landing in Canada of any immigrant or other passenger who is suffering from any loathsome, dangerous or infectious disease". Trachoma is included in the Act.

In South Africa, according to Harman,[2] Trachoma is not a common disease. "South Africa is second to no country in dustiness and brilliancy of sunshine, yet my experience was that conjunctivitis is no more frequent there than in England. During my period of service in

1. Boldt, loc. cit. p. 11
2. Harman, loc. cit. p. 12.

the Army Medical Department, 1900-1901, I had charge of British and Colonial troops. I remember well a severe case of gonorrhoeal conjunctivitis, but ordinary catarrhs were rarities, and of Trachoma I saw no sign. - - - - I examined many negroes on stations and in their own villages of ramshackle dwellings on the veldt, and save for a couple of "White Kaffir" (albino) children who had blepharitis, I saw no eye disease. I had charge for a long time, and was in contact with many hundreds of Boer prisoners. There was no evidence of any prevalence of conjunctivitis, past or present."

In Egypt, at the present day, Trachoma is perhaps more generalised than in any other country in the world. It prevails in all parts of the country, and amongst all the different races. According to MacCallan,[1] 95% of the population are affected. "None of the races which inhabit Egypt - fellahīn, Arabs, Berberines, Sudanese, Europeans - are immune from the disease, and all suffer equally when exposed to the same conditions of contagion, filth and overcrowding."

Trachoma is epidemic in all parts of the Indian Empire, and though most prevalent in the dry plains of the Punjab and the United Provinces, it is by no means rare in other districts. Numbers of patients have been treated by us who lived at altitudes varying from 1000 to 8000 feet above sea level. All religions and castes are equally prone to the disease. It is difficult to give

1. Mac. Callan, loc. cit. p. 3.

any accurate estimate of the percentage of people affected. Out of a total of 27,~~450~~ 540 out-patients treated by us in one year, 4226 were suffering from eye disease, and of these 2550 were diagnosed as suffering from Trachoma, that is, less than 10% of the total number. But many of those coming for treatment of other conditions would be suffering from Trachoma. Also many of those coming for acute ophthalmia doubtless had Trachoma, the symptoms of which were masked for the time by the acute superadded infection. It is a very common thing, especially amongst the poor and ignorant villagers, to see whole families infected. From continued observations, a rough estimate of the percentage of people affected in the Eastern part of the Punjab would be from 40% to 50%.

5. CLINICAL MANIFESTATIONS IN NORTH INDIA.

Trachoma, as seen in India at the present day, is essentially a chronic disease, both in its onset and in its course. The clinical manifestations of the disease are so varied that, for the purpose of detailed description, it is necessary in some way to classify its different forms. Many different classifications have been adopted. The majority of these have hindered rather than helped our understanding the course of the disease. Some text-books have divided Trachoma into acute and chronic. I shall attempt to prove later that this is inaccurate. Another common classification divides the disease into three forms: the granular, the papillary, and the mixed. This classification is misleading. Swelling and infiltration of the papillary bodies exists to a greater or less extent in all forms of active Trachoma. It exists also in other forms of conjunctivitis. It is probable, moreover, that when it exists in Trachoma in its typical raspberry formation, the extreme papillary hypertrophy is due, not so much to Trachoma, as to a superadded infection.

The classification we shall adopt is a slight modification of the one used by MacCallan.[1]

There are 4 stages of the disease:-

I. The stage of onset.

II. The stage of active Trachoma.

1. MacCallan, loc. cit p. 5.

III. The stage of resolution.

IV The stage of completed resolution.

The clinical features of each of these stages will be fully illustrated from the detailed notes of the series of 50 cases. There is no distinct dividing line between the different stages, one passing into the other. It must be distinctly understood, also, that the clinical picture of Trachoma, at least in the first three stages, may be obscured by a mixed infection. We shall endeavour as far as possible, in such cases, to distinguish the clinical manifestations of Trachoma from those of the superadded infection.

The great majority of the cases of Trachoma seen in N.India fall into Stages II and III. This is easily explained. In a country where acute conjunctivitis is common, and where practically everyone has had periodic attacks, the comparatively mild symptoms of early Trachoma attract no notice. Usually it is not until the vision begins to be affected, or some acute symptoms appear, that the people present themselves for treatment. In like manner, cases that come into stage IV have recovered from many of the troublesome symptoms, and unless the cicatrization has resulted in entropion or some other deformity, they are not likely to ask for treatment. Out of the series of 50 cases, there are only two in the first stage, both of whom are Europeans, and four in the fourth stage.

Trachoma I. The Stage of Onset.

Trachoma starts so insidiously, and the early symptoms are so mild, that the patients' attention may hardly be attracted to the disease. The following case of a European doctor is typical.

Case 1. A.B. Male, age 29. European.

Complaint. Burning feeling in the eyes, with a slight discharge in the mornings.

History. He arrived in India 18 months ago. He has examined and treated large numbers of patients suffering from ophthalmia, and he has not always been careful to disinfect his hands after examining cases. For the past six months he has complained of his eyes feeling dry and hot, especially on the margins of the lids. In the morning, vision is hazy until the eyes are bathed. Occasionally the eyes become somewhat inflamed, especially after being in the bright sun. He has never had any symptoms of acute ophthalmia.

Examination of Present Condition.

General Appearance. Nothing to note.

Lids. No swelling of the lids nor ptosis. The eyelashes are matted together.

Conjunctiva. The conjunctiva of the upper lids is slightly injected. This is more marked at the outer and inner corners of the upper margin of the tarsus, where the conjunctiva also has a roughened sand-paper appearance. There is some swelling of

the conjunctiva of the fornices, in which a number of small pale bodies the size of a pin's head are visible. In the conjunctiva of the lower lids and fornices there is nothing to note, beyond a slight congestion. In the ocular conjunctiva there is some injection of the vessels at the inner angle.

Cornea. Nothing to note.

Bacteriological Examination of Discharge. No definite organism seen.

(The subsequent course proved the case to be one of Trachoma.)

Such cases are likely to escape notice, even if the upper lid is everted. In North India, the glare of the sun, combined with the wind and dust, in the majority of people causes a mild irritation of the conjunctiva. This manifests itself by a slight roughening along the upper edge of the tarsal conjunctiva of the upper lids, and is caused by papillary hypertrophy. This condition, therefore, is not diagnostic of Trachoma in its first stage, but its existence should be looked on with suspicion and further evidence sought. This is to be found by careful examination of the upper conjunctival fornix, which is best exposed in the following way. Standing behind the patient, who is seated on a chair, one everts the upper lid in the usual way. The patient is asked to look down as strongly as possible without moving the head. The everted lid is now pressed steadily backwards against the margin of the orbit. This has the effect of further tilting the eye

downwards, and the whole of the fornix is exposed to view. To aid in the examination of early Trachoma, a binocular lens should be used. If in the upper fornix we discover small semi-transparent bodies, causing slight roughness, then Trachoma may be diagnosed, at least provisionally. The importance of a diagnosis at this stage cannot be exaggerated, because, if the disease is properly treated, a speedy cure results, and the conjunctiva is left practically normal.

It may be stated, however, that the diagnosis of the disease at such an early stage is by no means easy. I have notes of a case of another European, whose symptoms were almost identical with those described in Case 1.. He was examined by an eye specialist, who diagnosed it as an undoubted case of early Trachoma. The patient expressed himself unwilling to undergo the painful treatment prescribed for him. Three months later, with the onset of cooler weather, the subjective symptoms had disappeared, and on examination, there was nothing to note in his upper fornix. Two years later, his conjunctiva was healthy. This was undoubtedly <u>not</u> a case of Trachoma.

In the clinical picture of the first stage of Trachoma, therefore, there is nothing very definite.

The <u>Subjective Symptoms</u> are usually very mild: a slight burning feeling in the eye, especially towards night, gumming of the lids in the morning, and dimming of vision, owing to flakes of

secretion floating in front of the pupil.

Objective Symptoms. There is nothing to note about the eye externally. The conjunctiva of the upper lid is red and slightly roughened, especially along the upper border. This is due usually to papillary hypertrophy, but a few small semi-transparent bodies may also be present. The upper fornix is congested with small pinhead granulations, scattered over its surface. In stage 1, the small so-called granulations, though strongly suspicious, are not, in my opinion, absolutely pathognomonic of Trachoma. The ultimate diagnosis therefore depends on the subsequent course of the disease. Under suitable treatment, Trachoma, at this stage, may be easily cured by passing through stage III to stage IV, a few faint white lines on the tarsus and a paling of the conjunctiva of the fornix being the only signs left to show the previous existence of the disease. I have occasionally seen this result without treatment. This, however, is rare, and usually within a period varying from a few weeks to several months it passes into the second stage.

Trachoma II. The Stage of Active Trachoma.

In this stage, there is a great variety in the clinical manifestations. The following case is instructive, because it passed into the second stage whilst under observation.

Case 3. S.D. Female, age 25. European.

Complaint. Discharge from the eyes, with burning pain and slight swelling.

History. Patient came to India nine months ago. For the last three months has had a burning feeling in the eyes, and the eyelids are stuck together in the mornings with a viscid discharge. There is no history of any acute conjunctivitis.

Examination of Present Condition.

General Appearance. There is a heavy appearance about the eyes.

Lids. Slight ptosis and swelling of the lids.

Conjunctiva. The conjunctiva of the upper lids of both eyes is markedly congested and swollen. There are a few pale Trachoma granulations, like sago grains, scattered on the surface. The conjunctiva of the lower lids and fornices is congested, but no granulations are visible. The peripheral vessels of the ocular conjunctiva are injected. The cornea is clear. There is a fairly free muco-purulent discharge. On microscopic examination of the discharge, no definite organism is found.

The following are the chief points to note in the early second stage. There is an increase in the subjective symptoms, which are now severe enough to attract the patient's attention, and to cause him to come for treatment. The discharge has increased, causing sticking of the lids in the morning. The burning pain in the eyes and sensitiveness to light, causing continual blinking, are greater than in the first stage. The congestion and hypertrophy of the conjunctiva are more marked, and the granulations, or Trachoma bodies, are larger and more definite.

The next three cases are typical of Trachoma II at the height of its development.

Case 5. Ganga Dei. Female, age 4. Hindu.

Complaint. Watery discharge from eyes and nose for one year.

History. The mother states that for the last year the child has had trouble with her eyes,and there has been a continuous discharge. The eyelids are usually stuck together in the morning with mucous secretion, and sometimes the eyes have swollen up and become more inflamed.

Examination of Present Condition.

General Appearance. Heaviness of the upper and lower lids of both eyes, with marked ptosis and diminution of the palpebral aperture. There is redness along the lid margins, with excoriation at the outer angles. There is also a profuse discharge from the nose, with excoriation of the upper lip.

Lids. Matting of the eyelashes with muco-purulent discharge. The lids are swollen and thickened.

Conjunctiva. There is marked congestion and swelling of the conjunctiva of both upper lids and fornices. The palpebral conjunctiva presents a dark-red, unripe-mulberry appearance, due to papillary swelling. Between the papillary elevations, small,pale-yellowish granulations are scattered. The conjunctiva of the fornix protrudes in thick folds when the upper lid is everted, and shows similar scattered granulations. There is also marked swelling of the conjunctiva of the lower lids and fornices, with a few granulations visible. The superficial vessels of the ocular conjunctiva are injected. The caruncle is swollen, but shows no granulations.

Cornea. This is clear.

The lachrymal sac is involved.

(It is interesting to note that the child also had enlarged tonsils and adenoids. The marked papillary enlargement was due to the excessive reaction of the adenoid tissue of the conjunctiva in a scrofulous child. It may have been primary, associated with repeated attacks of phlyctenular conjunctivitis, as suggested by the history, and in such a case the Trachoma infection would be superadded; or it may have been secondary, due to an excessive reaction to the Trachoma infection.

Case 45. Abdul Rahman. Male, age 40. Mahommedan.

Complaint. Burning itching and watering of the eyes, with a feeling as of grit in them.

History. Has had symptoms for two years, much exaggerated during the last three months.

Examination of Present Condition. Patient is continually blinking, and holds his head down and turned away from the light.

Lids. There is slight ptosis of both lids, with some increase and irregularity of the eyelashes (commencing trichiasis). The lids have a brawny feel, due to infiltration and thickening of the tarsi, and they are everted with difficulty.

Conjunctiva. The conjunctiva of the upper lids is swollen, and is of a dark, brick-red colour, with very numerous pale, round Trachoma bodies scattered through it. Some of them are very superficial,

and have a calcareous appearance. The conjunctiva of the fornices is greatly swollen, and protrudes in folds. Along its surface, arranged in more or less regular rows, there are numerous granulations, greyish-red in colour, varying in shape and size, and resembling frog spawn. On pressure, some of the granulations rupture, and a softish grey mass is protruded. The ocular conjunctiva is inflamed, and there is a commencing pannus at the upper border of the right cornea.

The picture of Trachoma at the height of its development is a clear one. The subjective symptoms are still more marked. There is usually more discharge. There is more irritation of the eyes, and more photophobia. The general appearance of the patient is typical. His head is slightly bent forward. The eyelids are heavy and drooping, and the palpebral fissure is smaller, giving him a blear-eyed look. He is continually blinking. The drooping of the lids, or ptosis, is due chiefly to an increase in weight, caused by the thickening of the upper lid from infiltration of the tarsus. According to MacCallan,[1] it is also partly due to the infiltration of a levator muscle of the upper lid with trachomatous exudate, causing paralysis of the muscle. "This muscle is called musculus tarsalis superior, Muller's muscle, and consists of unstriped fibres."

The upper lid is more tightly pressed against the eyeball, it is more difficult to evert, and when it is everted folds of conjunctiva protrude, which keep it everted.

1. MacCallan, loc. cit. p. 10.

The changes in the conjunctivá, especially of the upper lids and fornices, are characteristic.

The papillary thickening varies from a fine velvety appearance to the appearance of a raspberry or an unripe mulberry. It represents the reaction of the adenoid layer of the conjunctiva, and (as has been stated) varies according as the infection is pure or mixed, and according to the general condition of the individual.

The Trachoma bodies, or granulations, vary in size, shape and appearance. They are usually discrete, but in more advanced cases may join to form gelatinous-looking masses. They are described as resembling frog-spawn, or grains of cooked sago, and sometimes when arranged in rows in the upper fornices, as resembling strings of pearls. They vary in size from a pin-point to one-twelfth of an inch in diameter. They are usually more marked on the upper lids and fornices than on the lower, and also occasionally are seen on the ocular conjunctiva and on the semilunar fold and caruncle.

They will be discussed more fully under Pathology.

Pannus, though not infrequently seen in the second stage, is in our experience more common in the third stage, and it will be described later,

Whilst these cases are typical, and are necessarily described in detail, in order to give a clear picture of the course of the disease, they cannot be said to represent the majority of cases coming for

treatment. The greater number of patients are suffering from Trachoma plus a superadded infection, and in many cases it is the secondary infection that causes them to come. Full reference will be made to this after the remaining two stages have been dealt with.

Trachoma III, The Stage of Resolution.

The great proportion of the cases come under this stage. Trachoma is a disease which runs a definite course, and invariably ends by cicatrization. In this way it differs from most other forms of conjunctivitis, in that the conjunctiva does not return to normal, but is gradually replaced by fibrous tissue. The amount of fibrous tissue laid down in the process of resolution depends on the amount of hypertrophy that has preceded it. The course of the disease is finished when the whole of the trachomatous tissue (granulations and papillary hypertrophy) has disappeared, and the cicatrization of the conjunctiva is complete.

The following cases illustrate the different stages which are passed through before Trachoma IV, or the stage of completed resolution, is reached.

Case 4. Ramzan. Male, age 10. Mahommedan.

Examination of Present Condition.

Lids. No marked swelling nor ptosis.

Conjunctiva.

Right Eye. The conjunctiva of the upper lid is red and thickened. Between masses of dark-red inflamed tissue, faint white streaks of fibrous tissue are visible. These are arranged more or less according to a definite plan. About one-twelfth of an inch from the lower border of the lid, along the tarsus, in the position of the normal sulcus

subtarsalis, there is a white line of cictracial tissue. From this, faint white lines radiate upwards, dividing the trachomatous tissue into islands.

The upper fornix is dark red, and swollen with a few granulations. The semilunar fold and caruncle are inflamed, and there are one or two indefinite granulations on them.

Left Eye. In the left eye, the stage of resolution is less advanced. In the thickened conjunctiva of the upper lid, a few faint whitish streaks are visible, forming an irregular network.

In both lower lids the conjunctiva is less involved. There is no evidence of trachomatous tissue. Both lower fornices are pale and smooth.

Case 14. Bantu. Male, age 10. Christian.

Complaint. For the last two years has had repeated attacks of inflammation of the eyes, improving with treatment, then recurring.

Examination of Present Condition. There is ptosis of both eyes, with great thickening of the tarsi.

Conjunctiva. The conjunctiva of both upper lids presents the picture of islands of inflamed reddish-yellow tissue, with a rough surface, surrounded by a network of fine white connective tissue bands. Isolated granulations no longer are visible.

In the upper fornices the conjunctiva is smooth,and bluish-white in colour, with a few granulations still showing through.

The conjunctiva of the lower lids is dark-red in colour, and slightly hypertrophied, and shows a few scattered granulations. In the lower fornices, it is bluish-white in colour and smooth.

On the ocular conjunctiva of both eyes there are one or two white irregular-shaped masses. The lower and inner quadrant of the cornea of the right eye is covered by one of these masses. The peri-corneal

vessels of both eyes are injected.

These two cases present many of the features which are typical of commencing resolution. In the following three, the process of cicatrization has reached a more advanced stage.

Case 7. Nathu. Male, age 30. Hindu.

Complaint. No complaint. Came with his son, who was suffering from Trachoma. On enquiry, he states that 15 years ago he had a severe attack of conjunctivitis. Since that time, he has not had any complaint in his eyes.

Examination of Present Condition.

Conjunctiva. On the lower half of the upper lid of each eye, the conjunctiva is pale and smooth. Towards the upper border of the tarsus, it is thickened, and is broken into reddish-grey islands by connective tissue bands. The upper fornix is slightly swollen, but smooth, and of a milky-white appearance. The conjunctiva of the lower lid is smooth.

Case 8. Thakari. Female, age 50. Hindu. Mother of Nathu (No.7), and lives in the same house as her son and her grandchild, who has Trachoma.

Complaint. She makes no complaint of eye disease.

Examination of Present Condition. The palpebral orifice is small, and there is slight incurving of the lids.

Conjunctiva. On the conjunctiva of the upper lid of the right eye, there is irregular scarring, with masses of gelatinous tissue. On the upper lid of the left eye, the conjunctiva is smooth, except for a pale, gelatinous, crateriform mass on the outer side.

The conjunctiva of both upper fornices is pale and white, and very much contracted, so that it is difficult to evert the lids. The caruncle of the right eye is deformed, and is replaced by trachomatous

and scar tissue.

The upper quarter of the right cornea is hazy from old pannus.

There is immature cataract in both eyes.

Case 16. Tulsi. Female, age 40. Hindu.

Complaint. Dimness of vision in the right eye.

History. For the last three years has had no attacks of conjunctivitis, but before that she had frequent attacks of severe conjunctivitis, with swelling of the lids, redness, pain, etc..

Examination of Present Condition.

Lids. Heaviness and folding of the skin of the upper lids, with ptosis.

Conjunctiva. The conjunctiva of the upper lids is smooth, and for the most part of a pale whitish colour, with broad bands of connective tissue, which have almost entirely replaced the trachomatous material. The conjunctiva of the fornices is much contracted, and is smooth and pearly white. On the lower lids the conjunctiva is smooth, and goes from the tarsus almost directly on to the eyeball, the conjunctiva of the fornix having been entirely replaced by fibrous tissue, which has contracted down, thus destroying the loose folds of the fornix. In the lower lids the stage of complete resolution, or Trachoma IV, has been reached.

On the upper part of the cornea of the right eye there is faint scarring and pitting, and a few vessels run on to the edge. There is also an opacity of the left cornea.

There is a scanty foamy discharge from the eyes.

This case brings us up to the last stage of the disease, or Trachoma IV, the Stage of Complete Resolution.

Case 46. Ganga Dei. Female, age 55. Hindu.

Complaint. No vision in the right eye, and dimness of vision in the left.

History. The right eye has gradually become blind. Some years ago she had repeated attacks of inflammation of the eyes, with continued irritation and discharge. During the last five years these symptoms have disappeared. She complains of a feeling of dryness in the eyes.

Examination of Present Condition. The palpebral fissures are much narrowed. There is commencing entropion of both upper lids, which are more convex and boat-shaped than normal.

Conjunctiva. The conjunctiva of the upper lids is pale and smooth, with white lines of connective tissue on its surface. The conjunctiva of the fornices is pale white and smooth. It is very much contracted, so that the normal folds of the fornix have almost disappeared. The conjunctiva of the lower lids presents a similar appearance. The semilunar fold and caruncle have been replaced by fibrous tissue. In the right eye there is a mature senile cataract, and there is an immature cataract in the left eye.

There is no discharge from the eyes.

With these notes before us, we are now in a position to study, from a clinical aspect, the process by which nature combats Trachoma. After the disease has advanced to a certain stage, changes begin to take place in the trachomatous tissue. The typical sago-grain granulations frequently become fused into masses of pale, gelatinous-looking tissue, which may sometimes be expressed with ease from the lids. The process of cicatrization now begins. A few faint whitish lines appear in the midst of the red and thickened conjunctiva. These become more

numerous, and are arranged so as to form an irregular network, in the meshes of which is the trachomatous tissue. Frequently, as in Case 4, there is a well-marked white line of cicatricial tissue above the free border of the lid, and from this line irregular strands radiate. The strands of cicatricial tissue gradually broaden out, and the islands of hypertrophied conjunctiva become smaller, until eventually, the whole of the trachomatous tissue has been replaced by connective tissue, the amount of scarring depending on the amount of preceding hypertrophy. A similar process goes on in the fornices, which become milky-white in colour, and smooth, and frequently very much contracted.

It must not be imagined that once the process of resolution has commenced, it goes on uninterruptedly, until the stage of complete cicatrization is reached. On the other hand, the course of the disease during this stage is marked by repeated exacerbations. It has frequently been observed by us that cases which under treatment are cicatrizing satisfactorily, suddenly, and for no explainable reason, flare up. The trachomatous tissue is increased in amount, and the treatment has to be started all over again. A super-added infection may also cause an exacerbation of all the symptoms, as we shall see later.

During the third and fourth stages of Trachoma the subjective symptoms gradually lessen, until in mild cases they disappear and the patient has no complaint. The discharge decreases in amount, frequently becoming of a white foamy nature. It is worthy of note that, of the last three cases, none presented themselves for the treatment of Trachoma. The first two were examined without having made any complaint, and the third was observed in the course of the examination for cataract.

In severe cases the result is not such a happy one. With

advancing cicatrization of the conjunctiva, in the majority of cases deformities follow, with disastrous results to the eye. The commonest of these is entropion. These will be described under the sequelae of Trachoma.

We have now traced the disease from its earliest noticeable beginnings until it has reached the stage of complete resolution, or cured Trachoma. In the notes of the cases illustrating the different stages, I have endeavoured as far as possible to give the picture of what in my opinion is the course of uncomplicated pure Trachoma.

PANNUS.

So far we have dealt with Trachoma as it affects the conjunctiva, but the disease does not confine itself to the conjunctiva. During any of the first three stages, it frequently affects the cornea, when it is known as pannus, or pannus trachomatosus. Pannus almost invariably, though not always, affects the upper part of the cornea. There has been much discussion as to whether it arises by direct continuity with the trachomatous tissue of the upper lid and fornix, through the ocular conjunctiva, or by contact with the affected lid. In the majority of cases, the intervening ocular conjunctiva is free from the disease, so it is probable that the cornea is infected by continual contiguity with the diseased lid. This also accounts for the fact that the upper part of the cornea is almost invariably the part affected, for it is in contact with the diseased upper lid day and night. The severity of the pannus does not seem to bear any direct relationship to the severity of the disease as it affects the conjunctiva. Cases suffering from severe Trachoma may have no pannus, and, on the other hand, very mild cases may be complicated with a

thick fleshy pannus, involving the whole of the upper half of the cornea.

Case 18. Gulam Husain. Male, age 45. Mahommedan.

Complaint. Burning and itching of the eyes with a watery discharge for the last three months.

Examination of Present Condition.

Conjunctiva. The conjunctiva of the lids shows the picture of Trachoma II at an advanced stage, with numerous granulations, some of which look calcareous. The conjunctiva of the upper fornices presents no granulations; it is less swollen and paler, having reached the stage of commencing resolution. There is no trachomatous tissue on the ocular conjunctiva.

Cornea. The upper fourth of the right cornea is covered with a thin vascular pannus, with a well-defined lower straight edge. The pannus is of a reddish-grey colour, giving the part of thecornea affected an uneven surface. Three or four large branching vessels passing down from the limbus are plainly visible. The rest of the cornea is clear.

In the left eye, the upper fourth of the cornea presents a grey, cloudy appearance, with small irregular facets on its surface, but no vessels are visible on the cornea the conjunctival vessels at the upper limbus are dilated.

Case 26. Ali Husain. Male, age 54. Mahommedan.

Complaint. Redness of the eyes, watering and photophobia.

History. Three years ago, in the cold weather, he first began to have trouble with the eyes. They became inflamed and swollen, but after five or six days began to improve. He had several such attacks. For the last eighteen months has had almost continual trouble, and his vision has become impaired.

Examination of Present Condition.

Lids. The conjunctiva of the upper lids presents a network of cicatricial tissue, in the meshes of which are islands of dark-red hypertrophied conjunctiva. The fornices are somewhat contracted. The tarsi of both lids are greatly thickened and increased in size, so that the lids droop down over the cornea.

Conjunctiva. The ocular conjunctiva is greatly inflamed, with large vessels running in from all sides. There is also peri-corneal injection, more marked at the upper borders of the cornea.

Cornea. Covering the upper third of the cornea of each eye there is a thick fleshy pannus, with a network of vessels running down from above, and also one or two large vessels running in from the sides to its lower border. The surface of the pannus is studded with irregular projections, which have a gelatinous appearance.

At the lower border of the right cornea, there is also a smaller pannus, which is thinner and less fleshy in appearance.

The iris of the right eye is somewhat hazy.

The pathology of the condition will be considered later. It is sufficient to state here that if the pannus has not progressed too far, it is capable of complete retrogression. On the other hand, it may advance until practically the whole of the cornea is covered with the trachomatous tissue and vision is almost completely gone. It may be associated with ulcers of the cornea, usually situated at its free border. In these cases, permanent opacities of the cornea result. It may also infiltrate the deeper layers of the cornea, in which case it can never completely resolve and leave the cornea clear. The cornea in this way also may lose its elasticity and become softened, so that anterior staphyloma is formed. Iritis

and iridochoroditis may also follow, causing total destruction of the vision of the eye, and sometimes even resulting in phthisis bulbi.

The following cases illustrate some of these disasters.

Case 24. Khansi. Male, age 36. Hindu.

Examination of Present Condition. Severe Trachoma of right eye, in the stage of commencing resolution.

Conjunctiva. There is marked injection of the ocular conjunctiva, especially at the upper and lower poles, and also circumcorneal injection.

Cornea. The whole of the cornea of the right eye, except for a small area in the centre, is covered with a thick, dark-grey, gelatinous pannus, with large vessels running in from all sides. The central part of the cornea is hazy, and the pupil is not visible. Vision in the eyes is reduced to distinguishing light from dark.

(This case was treated with subconjunctival injection of potassium cyanide - 1 in 4000. Six days later, the following note was made:-

"The pannus, except at the upper limbus, has lost a great deal of its fleshy appearance. The cornea below is clearer, and the pupil and iris are now visible. Vision has considerably improved."

This will be referred to again under treatment.)

Case 22. Mandah. Male,age 40. Mahommedan.

Examination of Present Condition.

Conjunctiva. Marked injection of the ocular conjunctiva of both eyes, especially the right.

Circumcorneal injection of the right eye.

Cornea. ~~In~~ the right eye, a reddish-grey fleshy mass extends down

over the upper half of the cornea. It is very vascular. At the inner edge of the cornea there are several small distinct facets. At the lower and inner quadrant, there is a projecting mass of white tissue, with a corneal ulcer at its free edge.

Case 12. Makhan. Male, age 25. Outcast.

Examination of Present Condition.

Conjunctiva. The conjunctiva is in an advanced stage of Trachoma II.

Cornea. Around the margin of the right cornea, there are several small, white, projecting masses of tissue, with dilated vessels. There are irregular opacities over the surface of the cornea, which is also facetted.

In the left eye there is marked pericorneal injection. The whole of the cornea is opaque and covered with white, thickened, irregular masses, with branching vessels running in from the limbus on all sides.

The iris of the right eye is hazy and immobile. The tension of the eye is increased. There is no vision in the left eye.

The remaining complications and sequelae of Trachoma will now be dealt with.

There is no doubt that an eye infected with acute conjunctivitis is more liable to become infected with Trachoma than a healthy eye. The reverse is also true.

At certain seasons of the year, especially in the late spring and early summer months, epidemics of acute conjunctivitis are very common in N. India. These are caused most frequently by the Koch-Weeks and Morax-Axenfeld bacilli. On studying the history of a number of cases suffering from Trachoma, it was frequently noticed

that for several years in succession about the month of April the patient had had an attack of acute conjunctivitis, with pain and redness of the eyes, swelling of the lids, photophobia, and a free discharge. These symptoms passed off in a week to ten days. After the last of several attacks, the symptoms did not disappear as formerly. The patient came for treatment, and was found to be suffering from Trachoma in a fairly early stage. It is evident that in these cases the typical recurrent attacks of spring catarrh preceded and predisposed to the Trachoma infection. Many cases of so-called acute Trachoma start in this way.

At any stage of its course before complete resolution has taken place, Trachoma is liable to be complicated by a superadded infection. This superadded infection is caused most frequently by one of the three following organisms:- the gonococcus, the Koch-Weeks, or the Morax-Axenfeld bacillus.

TRACHOMA COMPLICATED BY THE GONOCOCCUS.

Case 10. Gulab. Male, age 25. Hindu.

Complaint. Diminished vision in the right eye.

History. Three months ago the right eye became acutely inflamed and swollen. He was unable to open it for 6 to 8 days. The eye was painful, and there was a profuse discharge. The left eye was not affected. When he was able to open the eye, the vision was gone. Since then the sight has gradually improved, and he now has about half vision. Since childhood he has been subject to recurrent attacks of conjunctivitis.

Examination of Present Condition.

Right Eye. Both lids are heavy and swollen, and there is marked

ptosis of the upper lid.

The conjunctiva of the upper lid shows marked papillary hypertrophy and has a spongy appearance. It bleeds readily. A faint network of cicatricial tissue and a few granulations are visible, but are largely overshadowed by the papillary hypertrophy.

The upper fornix has a bluish-white appearance, with granulations showing through.

The conjunctiva of the lower lid presents a milder form of the above, and the lower fornix is smooth.

The ocular conjunctiva is considerably inflamed.

Surrounding the greater part of the cornea, there is a large, xxxx crescentic-shaped, superficial depression, with facets along the upper edge. This is a healed superficial ulcer.

There is a mucopurulent discharge, containing a very few gonococci lying ~~astride~~ outside the cells.

Left Eye. The left eye presents none of the symptoms of acute inflammation.

The conjunctiva of the upper lid is intersected by deep broad bands of cicatricial tissue, surrounding islands of reddish trachomatous tissue. The fornix is pale and smooth.

The history of this case is clear. Resolution of the Trachoma was proceeding satisfactorily in both eyes, when the right eye became infected by the gonococcus. The trachomatous condition of the eye having lowered its normal resisting power, predisposed to the gonococcal infection. The right eye became acutely inflamed, presenting all the symptoms of acute blennorrhoea. The left eye in this case miraculously escaped infection. Owing to the extreme oedema of the lids, the patient was unable to open the eye for some days. When

eventually the swelling of the lids subsided, and he was able to open the eye, the vision, which before the acute attack had been normal was almost totally gone. The loss of sight was caused by ulceration of the cornea. This, as we know, is one of the common complications of acute blennorrhoea, and is caused by the gonococcus in the pent-up discharge acting directly on the corneal epithelium, whose resistance is lowered by the continual presence of the discharge and by the increased pressure from the lids and oedematous conjunctiva causing diminution of lymph supply. The acute symptoms gradually subsided, the corneal ulcer healed, and the vision began to improve.

The great papillary hypertrophy which remained three months after the acute attack is typical of this condition. It is frequently seen complicating cases of Trachoma, and even if the gonococcus cannot be found in the discharge, there is no doubt that if there is a history of an acute attack similar to the above, it is due to a superadded gonococcal infection. According to MacCallan, this tumefied condition of the conjunctiva, which has a velvety granular appearance, may last for a long time. "Myerhof calls it 'florid Trachoma', which also expresses the condition well."[1]

TRACHOMA COMPLICATED BY THE KOCH-WEEKS BACILLUS.

Case 20. Tawan. Female; age 7. Chumar caste.

Complaint. Pain, swelling, redness and discharge, especially from the right eye.

History. For the last three days she has had the above symptoms. Before this, she had a sticky discharge, but no acute symptoms.

Examination of Present Condition. The eyelashes are matter with mucopurulent discharge, which is free from both eyes. There is

1. MacCallan, loc. cit. p. 16.

slight swelling of both upper lids.

There is great swelling and redness of the conjunctiva of the lids, with a few discrete pale Trachoma granulations showing between the papillary hypertrophy. On the lower part of the ocular conjunctiva of the right eye there are a few small phlyctenular ulcers. The whole of the ocular conjunctiva is much injected.

Around the cornea of the right eye there is a crescentic pannus.

Koch-Weeks bacillus ~~was~~ is found in the discharge.

TRACHOMA COMPLICATED BY MORAX-AXENFELD BACILLUS.

Case 9. Champa. Female, age 5. Hindu.

Complaint. Free discharge from the eyes, with pain and swelling.

History. A month ago the eyes became swollen and inflamed. She could not open them for 15 days. The condition gradually improved, but the eyes have remained swollen, red and painful.

Examination of Present Condition. The lids of both eyes are swollen and heavy. There is a free mucopurulent discharge, and some excoriation of the lid margins. There is great papillary swelling of the conjunctiva, which is purplish-red in colour. The fornices are much swollen, and project in folds. The general appearance of the conjunctiva of the upper lids is that of coarse velvet. There are a few pale Trachoma granulations showing through.

The ocular conjunctiva is congested, especially on the inner side.

There is no affection of the cornea.

On microscopic examination of the discharge, a few Morax-Axenfeld bacilli are found.

These two cases are typical of large numbers, and it is evident from their history and examination that the acute symptoms are due

not to Trachoma, but to the secondary infection. This brings us to the consideration of whether Trachoma ever occurs in an acute form.

There is a growing weight of opinion in recent years that Trachoma is essentially a chronic disease, and that so-called Acute Trachoma is not an acute stage, but that it is due to a superadded infection. Until the cause of Trachoma is discovered, it is impossible to say definitely that this is the case, but in proof of it from our experience in India it may be stated:-

1. Typical cases have been observed in which the onset and course has been chronic throughout.
2. Cases presenting themselves for treatment of other eye conditions, such as cataract, have presented the picture of healed Trachoma, with typical scarring of the conjunctiva, without a history of any acute symptoms of ophthalmia.
3. So-called Acute Trachoma in N. India occurs at the time of year when epidemics of acute conjunctivitis are common, and there is no doubt that eyes already infected with Trachoma form a more favourable nidus for secondary infection.
4. In many of these cases of Trachoma with acute symptoms, well-known organisms causing acute conjunctivitis can be demonstrated in the discharge. In some it is true that no such organism can be found, but this is not to be wondered at, as the reaction to a secondary infection in a trachomatous eye is bound to last after the organism causing it has disappeared from the discharge. We have already proved that many of the cases of acute ophthalmia as described by older writers were caused by Trachoma plus an additional infection, and though in more recent years cases of

Trachoma with an acute onset have been described, on analysing them there is no definite proof that there was not a mixed infection. The weight of evidence, therefore, goes to prove that Acute Trachoma does not exist at the present day.

THE SEQUELAE OF TRACHOMA.

There still remain to be considered some of the sequelae of Trachoma.

We have seen how, in the process of resolution, the trachomatous tissue gradually disappears by the laying down of fibrous tissue. In mild cases of the disease, a cure may result in this way without any disastrous effects. If, on the other hand, the condition has been at all severe, the resulting cicatrization will be so great as almost certainly to cause some deformity of the parts affected. The commonest results of this are seen in the following two cases.

Case 13. Rahmo. Female, age 40. Mahommedan.

Complaint. Watering of the eyes and dimness of vision.

History. For two or three years has had trouble with the eyes, especially the left eye.

Examination of Present Condition. Heavy, blear-eyed appearance, with ptosis. The lids of both eyes are thickened. The tarsi of both upper lids are greatly thickened and incurved at the lower edge (entropion). The eyelashes of the left upper lid are directed downwards and inwards, and rub against the cornea (trichiasis).

The conjunctiva of both upper lids and fornices is covered for the most part with bluish-white scar tissue. A few scattered calcareous-looking granules and islands of dark-red degenerating trachomatous

tissue remain. The fornices are much contracted, and the conjunctiva of the lids passes almost directly on to the eyeball.

The ocular conjunctiva of the left eye is congested.

The left cornea is covered with a diffuse opacity, with no vessels running on to it. The pupil is not visible.

The vision is reduced to distinguishing light from dark.

(An operation for trichiasis and entropion was performed on the left upper lid.)

Case 21. Daulat Ram. Male, age 80 years. Hindu.

Complaint. Redness and watering of the eyes, with pain and diminished vision. This condition has existed for about ten years.

Examination of Present Condition. There is ptosis of both upper lids, with marked incurving of the lower edge, so that the eyelashes sweep over the cornea.

The conjunctiva of the upper lids is ~~lined~~ intersected with lines of cicatricial tissue, which radiate up from a broad white band lying along the region of the sulcus subtarsalis. Some thickened inflammatory material still remains. The fornices are much contracted.

In the centre of the cornea of the right eye there is a dense leucoma, also a thickened, white, irregular mass near the upper limbus.

The vision of the right eye is greatly diminished.

Unfortunately, trichiasis and entropion are very common sequelae of Trachoma, and not a day passes without some cases coming for treatment. Frequently the cornea has been affected to such a degree that they are hopelessly blind. Trichiasis and entropion are caused by excessive contraction of the conjunctiva, as well as the tarsus. As the process of cicatrization advances, the conjunctiva of the upper lid contracts down on to a dense band of white fibrous tissue, which

runs parallel to the lower edge of the lid, $\frac{1}{10}$ th. to $\frac{1}{12}$ th. of an inch above its free margin. This causes the lid to curve, like a bow whose string is being tightened, so that now the lower edge of the lid, instead of looking downwards and outwards, looks downwards and inwards.

During the stage of active Trachoma the tarsus is always to a greater or less degree infiltrated with inflammatory material. This infiltration is greatest near the lower margin, where it spreads in along the vessels which perforate the tarsus here to reach the conjunctiva. When the stage of resolution begins, the inflammatory tissue of the tarsus also becomes replaced by fibrous tissue. This is most marked where the infiltration was greatest, and the normal curve of the tarsus, which has now lost its elasticity, becomes greatly increased, causing the lower edge of the lid to be further curved in. This is the chief cause of entropion. As this process advances, the inner sharp border of the lid becomes rounded off by pressure, and the eyelids now begin to sweep over the cornea and cause irritation. The eyelashes also, instead of lying in one plane, become irregularly placed. This is known as districhiasis.

The conjunctiva of the lids may become contracted to such a degree that it is replaced by a white band of scar tissue. The conjunctiva of the fornix disappears. The upper lids are everted with difficulty, and when they are, it is seen that the conjunctiva passes almost directly from the lids on to the eyeball.

Cicatricial bands may form between the lids and the eyeball. This condition is called symblepharon.

The contraction of the tarsus may also progress to such a stage that the lower border of the lid is turned completely inwards, so

that the skin of the lid now rests on the eyeball. The palpebral fissure contracts, and the patient goes about with the eyes held tightly shut, owing to the severe irritation and photophobia resulting from it. This spasm caused by the painful condition tends to increase the deformity.

The cornea is early affected by the irritation of the eyelashes and the pressure from the incurved lid margin. It becomes infiltrated and hazy, ulcers develop, and eventually, if the condition is not relieved by operation, it becomes covered by dense fleshy and vascular opacities. Anterior staphyloma may occur from softening of the cornea.

Inflammation of the iris and of the choroid may also take place, resulting in complete destruction of the interior of the eye, and perhaps eventually in phthisis bulbi.

The following case illustrates what is perhaps the worst sequela of Trachoma, namely, xerosis conjunctivae.

Case 41. Gulam Rasul. Male; age 60. Mahommedan.

Complaint. Dryness and burning of the eyes, and marked diminution of vision. This condition has gone on, steadily getting worse, for the last few years.

Examination of Present Condition. The palpebral aperture is diminished in size. There is entropion of the upper lids, and entropion and trichiasis of the lower. The conjunctiva of the lids is pale and cicatrized, and it has none of the appearance of mucous membrane. The folds of the fornices have disappeared.

The ocular conjunctiva has a similar dull, lustreless appearance, with a few large injected vessels on its surface.

The cornea is dull and hazy.

He can just distinguish light from dark. The puncta lachrymalia are not visible. The eye has a dry appearance, and there is no flow of tears. In this case, the conjunctiva has been completely changed into cicatricial tissue, obliterating the openings of the lachrymal ducts, and destroying the glands of secretion. The cornea eventually suffers from lack of its normal moisture. It becomes dry and opaque, and the epithelium of its surface becomes thickened, until it may come to resemble epidermis. The eye is then incurably blind and intensely irritating and painful.

6. ETIOLOGY & PATHOLOGY.

ETIOLOGY.

Before the outbreaks of "Egyptian Ophthalmia" at the beginning of last century, the etiology of Trachoma had attracted little attention. Following the serious epidemics, which, starting in the Armies, later spread to the civil population of Europe, the study of the cause of this disease was taken up with great enthusiasm. From then up to the present time, the study of the etiology of Trachoma has been pursued with such zest, that perhaps more has been written on the subject than on the etiology of any other infectious disease of the eye, and certainly more micro-organisms have been described as the morbific agent than in any other infection.

In the early years of last century, the writers on the subject were by no means convinced as to the contagious nature of Trachoma. They arranged themselves into two opposing schools. One stated that the disease was transmitted by the air (Aerial Infection Theory), the other that it was transmitted only by contact (Contagion Theory). The controversy is dealt with in one of the works of Sydney Stephenson[1], from which the following summary is largely taken.

Most of the French surgeons, including Larrey, believed in the Aerial Infection Theory. In 1821, Muller, a surgeon in the Prussian Army, writing in support of this theory, stated that the following three conditions were necessary:-

(1) A patient suffering from ophthalmia.

(2) Atmosphere polluted with human exhalations.

(3) The existence of currents of air capable of carrying the materia morbi.

1 Stephenson, loc. cit. p. 29.

Many ingenious attempts were made to explain the exact way in which the infectious molecules were disseminated. Watery emanations were supposed to arise from the diseased eyes, filling the air, and attaching themselves to any substance.

It was even suggested that looking at a person with watery eyes was enough to cause the disease.

The Aerial Infection Theory was still held by von Graefe in 1864 and by von Arlt as late as 1881.[1]

From the beginning, this theory was opposed by British surgeons, headed by Vetch and McGregor, who had noticed that the attendants of patients did not catch the disease. They supported the Contagion Theory, and proved it by the following:-

1. The experimental inoculation of men and animals.
2. The accidental infection of human eyes.
3. Auto-inoculation, when the second eye became infected from the other.

This is the theory held at the present day, when, from an increased knowledge of bacteriology, we are able to state definitely that Trachoma is an infectious disease, which is transmitted by contact with the secretion of an infected eye, the secretion containing the active agent. It follows, therefore, that the greater the amount of secretion in a trachomatous eye, the greater is the danger of spreading the infection. For this reason, Trachoma in the second stage and the early third stage is much more infectious. Also, as we have already observed, when Trachoma is complicated by a superadded infection, such as the gonococcus or the Koch-Weeks bacillus, the discharge is greatly increased. The degree of infectivity is

1. Bolder. loc. cit. p. 107.

correspondingly increased.

Before passing on to consider the specific organism of Trachoma, we will briefly mention the more important predisposing causes. These fall under two main headings:,

In the first (I) we have anything which in any way lowers the resisting power of the conjunctiva.

In the second (II), any condition of living which facilitates contagion of the eye of an uninfected person.

I. The main factors in lowering the resistance of the conjunctiva have for the most part already been mentioned.

We have seen how acute conjunctivitis, occurring, as it does, in epidemic form, predisposes to Trachoma infection. This partly explains why, following such an epidemic, larger numbers of Trachoma patients are seen.

In the same way also, we saw how certain conditions of climate, notably the glare of the tropical sun and the irritation from dust, produced a mild inflammatory condition of the conjunctiva, lowering its resistance. During the early summer months in North India, before the monsoon breaks, these conditions of climate are at their worst. At this time of the year, there is a great increase in eye disease, including Trachoma.

A great deal has been written about the influence of climate on Trachoma, and it seems to me that its importance has been exaggerated. Under "Prevalence of Trachoma in the British Empire," we saw how the disease occurs in all parts, where there is every variety of climate. We also know that Europeans can live in countries, such as Egypt and India, where the disease is most prevalent, and with ordinary care run little risk of being

infected. We may conclude, therefore, that Trachoma may flourish in any climate, and that no climatic conditions of themselves are sufficient either to cause the disease or to greatly predispose to it.

Certain general diseases also would seem to predispose to Trachoma by lowering the resisting power of the conjunctiva. The most marked of these is scrofula. Scrofulous children with enlarged tonsils and adenoids and a constant discharge from the nose are frequently found to be suffering from Trachoma. Scrofula is frequently complicated by phlyctenular conjunctivitis, and a hypertrophy of the adenoid tissue of the conjunctiva remains for a long time after the attack has passed off, thus forming a favourable nidus for the Trachoma infection.

II. The conditions of living which facilitate contagion may be briefly summarised. They are overcrowding, with lack of cleanliness and ignorance of the simplest laws of hygiene. All of these are too commonly found in India. Ninety-five per cent of the people of India live in small villages. The typical village in the North consists of a group of mud houses closely grouped together. The houses are low and small, often consisting of only one or two rooms. The custom in India is for the son when he marries to bring his wife to his parents' house; so that there are frequently three generations living in one house. At night, the children have to sleep several in a bed. The bedding consists of a cotton quilt, in which they wrap themselves, and which is never washed. When one of the children suffers from eye disease, the usual way for the mother to wipe away the discharge is with the border of her "chaddar", a loose garment worn by all Indian women over the head and thrown back over the shoulder. With the

same border she cleans the faces of the other children, and so spreads the infection. Another common practice is for the women to darken their eyelashes and those of their small children with a black antimony powder called "kajal". This is usually kept in a small ornamental brass vessel and applied with a brass rod. The same rod is used for all and is never washed. There is no doubt that the chief mode of infection is the family, and we have frequently observed households every inmate of which showed evidence of the disease. Living under these conditions, it is difficult to imagine how if one person in the house becomes infected with ophthalmia, the others can escape.

Moreover, the irritation of the eyes causes those who are infected to be continually rubbing their eyes. Their fingers contaminate anything which they handle. The children of the village play together with the same toys, and in this way one child infects the others.

Flies, which are commonly seen clustering round the eyes of babies suffering from conjunctivitis, probably play a part in the spread of the disease. It has been denied that flies carry the infection, because, though attracted to the discharging eyes, it is stated that they do not enter the healthy conjunctiva. I have frequently seen a small variety of fly which is very persistent in its endeavours to alight on the eyes of people who are not suffering from conjunctivitis.

The religious customs connected with bathing, both amongst the Hindus and amongst the Mahommedans, doubtless play a part in spreading the infection. At certain dates in the Hindu calendar, and especially at the time of any eclipse, Hindus flock in thousands to

their sacred bathing places. These are frequently nothing but big ponds full of stagnant water. At the fixed time, they crowd down into the water and bathe themselves all over. It is a common belief in N. India that no large body of water can become impure, no matter how much it may be defiled.

THE ACTIVE AGENT OF TRACHOMA.

Little as yet is known definitely about the active agent of Trachoma. Because of the fact that Trachoma is frequently associated with other forms of conjunctivitis, especially those caused by the gonococcus and the Koch-Weeks bacillus, the theory has frequently been propounded that Trachoma is not a disease by itself, but simply a later manifestation of other definite varieties of conjunctivitis.

Harman,[1] as late as 1905, after discussing the problem of the nature of the infectious agent, states:- "For the present, then, we may take it that the bacteriological examination of Trachoma points in the direction of a causal connection with either, or possibly both, the Micrococcus Gonorrhoea or the Koch-Weeks bacillus." He goes on to state that because the gonococcus is an intracellular organism, its resisting power is much higher than that of the Koch-Weeks bacillus, which is extracellular, and concludes that there is "a balance in favour of the micrococcus gonorrhoeæ being the cause, or the most efficient cause of Trachoma." He illustrates by means of a diagram the following transition stages. The gonococcus causes purulent conjunctivitis. After a time, this becomes chronic, causing chronic papillary enlargement, which is Trachoma.

The Koch-Weeks bacillus may cause a mild mucopurulent catarrh,

1 Harman, loc. cit. p. 165.

which results in recovery, or it may cause a purulent ophthalmia. This passes through the same stages as the purulent conjunctivitis caused by the gonococcus, and results in Trachoma. Because the papillary enlargement seen in Trachoma is also seen following these forms of ophthalmia, Harman seems to argue that they are one and the same thing. The evidence brought forward to prove his theory is by no means conclusive.

At the present time, investigation as to the etiology of Trachoma is centred round Prowazek's "cell inclusions" and Linder's "initial bodies." The following is a brief epitome of our knowledge of the subject up to the present day.

In 1907, Halberstäder[1] and von Prowazek in Java, and Greef, Frosch and Clausen[2] of Berlin, discovered in the epithelial cells of the conjunctiva of persons suffering from Trachoma peculiar small granules. They were found also in the epithelial cells of the discharge. Von Prowazek was the first to see them; therefore they are known as Prowazek's cell inclusions. In their short essay on the subject, Halberstäder and Prowazek describe their findings as follows. "In Trachoma smears stained by Geemsa's method, one finds dark-blue granular inclusions in the protoplasm of the epithelial cells. At first small, round or oval, they apparently grow, and become less dark, and then fine red points appear in the masses. The red points increase rapidly

1. Halberstaedter und v. Prowazek, Ueber Zelleinschluesse parasitischer Natur bei trachom. Quoted by Linder, The Trachoma Question, Archives of Ophthalmology, Vol XLI, 1912. p. 333.
2. Greef, Frosch & Clausen, Investigations on the Origin and Development of Trachoma. Translation. Archives of Ophthalmology. Vol XXXVII, 1908. p. 406.

in number, and the blue masses gradually disappear." They called the blue masses "plastin", because they thought them to be a reaction product, formed by the action of the virus upon the cells, and represented by the red points. Introduction of the scrapings from trachomatous eyes into the eyes of orang-outangs produced in a few days a mild form of conjunctivitis with similar inclusions. These investigations convinced the authors that "Trachoma is an epithelial cell infection and placed it side by side with lyssa, variola, molluscum contagiosum etc., grouping these diseases under the name chlamydozoa (ZOA an animal, chlamys outer covering), because the inclusions often seemed to be surrounded by a coat." Shortly afterwards, Linder,[1] in the course of his investigations, discovered the following, which I will give in his own words. "The so-called plastin is only a particular stage or generation of the virus. In well fixed and stained sections, inclusions appear as follows:- blue, sharply-outlined, cocci-like bodies are seen in the cavities of the protoplasm of the epithelial cells. They multiply by special division, and later on are found only near the wall of the cavity at a time when red points appear in the cavities. These blue bodies, which I called 'initial bodies', are found not only in the cells,but extracellular as well,sometimes even in great numbers. . . . . Prowazek's inclusions are nearly always accompanied by these free initial bodies. It is for this reason that I believed in the parasitic nature of the Trachoma inclusions. All my findings were

1. Linder, loc. cit.

later corroborated by Halberstäder and von Prowazek." In conclusion, he states: "I believe that the initial bodies and the red points called the elementary bodies are alive, i.e. they are living organisms, and that the virus belongs to the protozoa."

The problem of the etiology of Trachoma seemed to have been solved, but some fresh problems were raised by the discovery of identical inclusions in other things.

In the year 1909, Heymann[1] stated that he had found Prowazek's inclusions along with the gonococcus in four cases of gonoblennorrhoea of the newborn. He concluded that, as the cause of the gonoblennorrhoea was definitely known to be the gonococcus, Prowazek's inclusions were probably a reaction product of the epithelial cells against the gonococcus as well as the agent of Trachoma. They were therefore neither the cause of nor typical of Trachoma.

About the same time, the inclusions were also found to be present in cases of ophthalmia neonatorum of non-gonococcal origin. Before this time, it had been proved by many observers that, in a large number of cases of ophthalmia neonatorum, no gonococcus could be found. Such cases usually started at a later period, 6 to 8 days after birth, and ran a more benign course, never causing ulceration of the cornea. In the majority of them, no pathogenic microorganism could be demonstrated.

The discovery of cell inclusions in such cases seemed to throw new light on the matter. The investigation was taken up with great

1. Heymann, Quoted by Linder, loc. cit.

enthusiasm, and after some controversy, it was proved that in nearly every case of non-gonococcal ophthalmia neonatorum inclusions are to be found, but, at least in the vast majority of cases, where the gonococcus is present they are not found. These cell inclusions could not be distinguished from Prowazek's inclusions. The question then naturally arose as to whether Trachoma and inclusion blennorrhoea of the newborn are the same disease. Linder was convinced from the beginning that they were one and the same, and that the inclusion blennorrhoea of infants was caused by the Trachoma virus, the infant being infected from a Trachoma of the genital passages. Typical cell inclusions had already been found in the genital epithelium of a woman whose child had suffered from inclusion blennorrhoea. He argued also that there must be a corresponding disease in the male urethra, and was able to demonstrate the cell inclusions in three cases of non-gonococcal urethritis. "Through similar findings - in the conjunctiva of the newborn, the genital passages of the mother, and the male urethra - the morphological cycle was complete."

The conjunctiva of monkeys inoculated from these three different sources produced an infection similar to the one produced by Trachoma. Further proof was added to this when in 1910 Wolfman[1] in Leipzig successfully inoculated two men with inclusion blennorrhoea. He states that genuine Trachoma followed, with the production of scar tissue. From these proofs it was held by some that inclusion blennorrhoea and

1. Wolfman, Quoted by Linder. loc. cit.

Trachoma were the same, both clinically and histologically.

Many objections have been raised to these conclusions, and considerable doubt exists at the present day as to whether Trachoma and inclusion blennorrhoea are caused by an identical virus, also as to whether in Prowazek's inclusions and Linder's initial bodies we have discovered the active agent of Trachoma. As proof against it, the following points have been raised. The clinical cause of Trachoma in man is not the same as that of inclusion blennorrhoea. If the diseases are the same, then the clinical description of Trachoma will have to be considerably revised.

The same statement applies to the conjunctivitis produced by the inoculation of Niger apes with Trachoma and inclusion blennorrhoea. Also similar inclusion bodies have been found in other conditions, such as the swine pest and spring catarrh, and even in the healthy conjunctiva.

Cell inclusions are found in by no means every case of Trachoma. Also the virus of Trachoma and of inclusion blennorrhoea has been found to be active after filtration through a Berkefeld filter, although the inclusion bodies are too large to pass through.

Greef,[1] writing in 1912, denies the significance of the inclusion bodies as the active agent in producing non-gonococcal blennorrhoea, or Trachoma. He considers the granules to be microorganisms of importance in nature's economy, of widespread occurrence, and as yet of

1. Greef. Present status of trachoma body problem. Archives of Ophthalmology. Vol. XLI. 1912. p. 56.

unknown significance.

It is interesting to note that in August 1914 the XIIth. International Congress of Ophthalmology was to have been held at St.Petersburg (Petrograd). One of the chief subjects for discussion at this Congress was to have been the etiology of Trachoma. A prize of 1000 kronen was offered by the Hungarian Minister of the Interior for the best work upon this subject. The papers were to be written in English, German, French or Hungarian. The outbreak of the European War prevented the Congress from meeting, and thereby undoubtedly delayed the solution of this still intricate problem.

Axenfeld,[1] in a paper which was to have introduced the subject at the Congress, after reviewing the work which has been done, raises a number of points which are still open to discussion. In his conclusions he states that there are serious difficulties in the way of accepting Prowazek's bodies as the infective agent in Trachoma, but the evidence in their favour is much more complete in the case of inclusion conjunctivitis in the newborn. Here they occur in greater numbers and are more constantly present. They vary more directly with the duration and severity of the disease, and are more uniformly transmissible to apes, where they set up a similar conjunctivitis. He also suggests that there may be two kinds of Prowazek's inclusions having the same morphology. Though in his opinion the inclusions are not specific, and are proved by many arguments not to be the essential cause of Trachoma, he suggests

[1] Axenfeld, Etiology of Trachoma, (Review) Archives of Ophthalmology, Vol XLIV 1915, p. 360 and Ophthalmoscope Vol. 13 1915, p. 199.

that very likely they are the determining cause, and may contain the parasite, and concludes by stating that "the solution of the Trachoma problem must be found in the further study of the Prowazek bodies."

The writers of some of the other papers which were to have been read at the Congress hold very divergent views, but add little to our knowledge of the subject.

Another recently reported work on the question is that of H. Noguchi and Martin Cohen of New York.[1] They state that they have succeeded in cultivating the so-called Trachoma bodies experimentally, thereby proving that they were actually living. The organisms cultivated by them vary in form, and are illustrated in a series of microphotographs. These organisms were isolated from cases of conjunctivitis in which inclusions were present, and from typical Trachoma cases in which the inclusions could not be demonstrated. They were not isolated from any other form of conjunctivitis without inclusions. They present the characteristic morphological features of Trachoma bodies, but the authors are not yet able to state definitely whether they are identical with them.

The most recently reported article on the subject by Salzmann[2] sums up the position of our knowledge at the present day.

"No uniformity of opinion has yet been reached concerning inclusion corpuscles. It is not yet positively determined what importance these

1 Noguchi and Cohen, Experiments in the Cultivation of so called Trachoma bodies Archives of Ophthalmology, Vol XLIII; p. 117.

2. Salzmann, Trachoma and Gonorrhoea, (review) Archives of Ophthalmology Vol. XLVII 1918, p. 94.

conditions have in Trachoma and inclusion blennorrhoea, and it is still a question whether these two diseases are related. The simultaneous occurrence of inclusions and gonococci is too rare to make a connection between the two probable. The clinical course and the spread of the two diseases differ. An infection with gonorrhoea from a perfectly pure inclusion blennorrhoea has not yet been observed. The involution forms of the gonoccus show certain resemblances to elements of the inclusion corpuscles, but this is also true of the Gram negative cocci."

From other proofs already mentioned, he concludes that Trachoma and Gonorrhoea cannot be said to be identified.

PATHOLOGY.

The normal conjunctiva consists of two layers, the epithelium and the substantia propria. The epithelial layer varies in different parts of the conjunctival sac. On the lids it is more firmly attached to the underlying structures. It passes over the cornea, forming its superficial layer.

The substantia propria or adenoid layer is composed of adenoid and connective tissue. The adenoid tissue is composed chiefly of lymphocytes lying in the network of connective tissue. The lymphocytes, especially at the upper part of the conjunctiva tarsi, may be grouped together, forming little masses, which project as tiny papillae on the surface of the conjunctiva.

The Pathology or Morbid Anatomy of Trachoma will be considered under the following headings:-

1. The Morbid Anatomy of Trachoma in its first and second stages.
2. The Morbid Anatomy of resolving Trachoma.
3. The Morbid Anatomy of pannus, or Trachoma of the cornea.

1. The Morbid Anatomy of Trachome I and II.

The essential feature of Trachoma in these stages is the Trachoma granulation, which will be described first. The granulations are situated in the substantia propria, or adenoid layer of the conjunctiva, lifting up the epithelial layer and forming projections. In the early stage, they are probably an accumulation of lymphocytes in the connective tissue network, without any capsule. A fully developed granulation is made up of the following structures:-

1. Capsule and Stroma.

There is a considerable difference of opinion concerning the capsule and stroma of the granulations. The capsule is a very indefinite structure, and is often incomplete. In the first place, it is probably formed by the growing mass of cells pushing together the existing connective tissue fibres. It is probable that it is not increased by the laying down of new fibrous tissue until the stage of cicatrization begins. The same statement applies to the stroma.

2. Cells.

The granulation is made up for the most part of a mass of cells. These vary in character from the periphery to the centre. At the

periphery the cells consist of small, round lymphocytes, with deeply staining nuclei. They are usually arranged symmetrically around the central part of the mass. The centre is composed of larger cells, whose nuclei stain less deeply. These make up the greater part of the granulation. They have been called epithelioid cells, because of their resemblance to epithelial cells. In reality, they are for the most part mononuclear leucocytes. Many of their nuclei show karyokinetic figures, and the cells appear to be undergoing degeneration.

In addition to these, there are a number of larger cells scattered through the granulation. They are very irregular in shape, and frequently have long protoplasmic processes. They contain all sorts of inclusions, such as broken-down nuclei, red corpuscles and brownish masses of pigment. The question of their significance has aroused much discussion, but so far nothing definite has been settled. Besides these, the granulation may also contain giant cells, mast cells, polymorphonuclear leucocytes and red blood corpuscles.

3. Blood-vessels.

When the granulations are fully developed, they are surrounded by a network of blood-vessels, from which thin-walled capillaries pass into the substance of the granulation.

The Trachoma granulation is always accompanied by other changes in the conjunctiva. These consist chiefly in a widespread infiltration of the adenoid layer with lymphocytes, accompanied by vascular hyperaemia and oedema. The surface area of the conjunctiva is in this way

increased and thrown into folds, which form the so-called papillae. Between these folds, are corresponding clefts, which on cross-section may present the appearance of tubular glands, which at one time they were wrongly supposed to be. The papillae consist of a delicate connective tissue stroma, packed with lymphocytes.

The epithelium covering the papillae with their intervening folds, as well as the granulations, is usually thickened. On the projecting surfaces it early loses its cylindrical nature and is replaced by flattened cells, which may proliferate to a great extent.

The tarsus is early infiltrated with round cells, which find their way in chiefly by the lymph spaces and along the course of the blood-vessels, especially those of the lower arterial arch. The ducts of the Meibomian glands are usually blocked by the inflammatory cells and exudate, causing the glands to undergo cystic degeneration and to atrophy.

The question now arises as to whether the above pathological condition is pathognomonic of Trachoma. Papillary hypertrophy we know occurs in other forms of conjunctivitis, and is simply the reaction of the adenoid layer to the irritation caused by the invading agent. Can the same be said of the granulation, or does it possess a specific importance in the diagnosis of Trachoma?

On microscopic examination of a section of the conjunctiva from a case of follicular conjunctivitis, cell masses are found which cannot be distinguished from the early Trachoma granulation. A similar

condition is found in the catarrh produced by the frequent instillation of atropin into the eye, and in other forms of conjunctivitis. It is now generally held, therefore, that the Trachoma granulation, though present in all cases of Trachoma at some stage, is not a specific pathological condition, but represents the reaction of the conjunctiva to a variety of irritants. At the same time, the excessive reaction in Trachoma, characterised by the formation of the granulations in large numbers and their subsequent course, combined with the other cicatricial changes in the conjunctiva, present a clinical picture such as we see in no other form of conjunctivitis.

2. The Morbid Anatomy of Resolving Trachoma.

The resolution of Trachoma is brought about by the laying down of new fibrous tissue, and its subsequent contraction. After a certain stage, new blood-vessels begin to appear in the midst of the inflammatory tissue, and the new connective tissue fibres are laid down alongside these vessels.

As the resolution commences, the granulations become surrounded by a connective tissue capsule, which is more marked on the deeper surface. As the fibrous tissue of the capsule contracts, the cells inside are crushed and degenerate. The granulation becomes infiltrated by connective tissue, which gradually replaces the cell mass. Occasionally the degenerating granulation may become calcareous. It may also rupture on to the surface as the result of necrosis of the overlying epithelium. In other cases, if the granulations are numerous, they

may, during the process of degeneration, fuse together, forming a gelatinous-looking mass. Here the epithelium and underlying structures have undergone a kind of hyaline degeneration.

At the same time, a change is going on in the papillae and the rest of the adenoid layer. The lymphoid cells become absorbed, and connective tissue cells are laid down. Fine bands of connective tissue begin to appear, forming a delicate network radiating through the tissue. As the fibrous tissue contracts, the papillae shrink, the inflammatory tissue becomes isolated into islands, and, as the resolution proceeds, the whole of the adenoid layer gradually becomes converted into connective tissue, which is covered by flattened epithelial cells.

A similar process goes on in the inflammatory material which has infiltrated the tarsus. As the newly laid down connective tissue contracts, it results in an increase in the normal curvature of the tarsus and entropion. Some writers think that this incurving of the free border of the tarsus is due solely to the contraction of thick conjunctival fibrous tissue on the inner surface of the tarsus, where the union between the two is very firm. MacCallan[1] considers it to be due to changes in the tarsus ~~only~~. It is probably due in most cases to a combination of both causes. Sometimes the new fibrous tissue laid down in the tarsus proliferates to such an extent as to form small nodular fibromata.

We have already stated that the amount of cicatrization depends on

1 Mac. Callan, loc. cit. p. 24.

the amount of pre-existing hypertrophy. In severe cases, the whole of the conjunctiva becomes transformed into cicatricial tissue. The glands of secretion are destroyed. The conjunctiva becomes dry, and the epithelial cells come to resemble those of epidermis. This condition is known as xerosis.

3. The Morbid Anatomy of Pannus.

Pannus, or Trachoma of the Cornea, starts as a rule at the upper border of the cornea, and spreads down between the epithelium and Bowman's membrane. The tissue composing the pannus is very vascular and is infiltrated with lymphoid cells, which may be grouped together to form granulations. If the pannus is not severe, it may retrogress so that no trace of it is visible to the naked eye. If Bowman's membrane is destroyed, the substance of the cornea becomes infiltrated. This results in permanent changes, which vary according to the severity of the infiltration. In milder cases, after retrogression a faint leucoma may remain; in more severe cases, the opacity is denser. If the infiltration has spread more deeply into the cornea, it may become weakened by the intraocular tension and bulge forward, either locally or as a whole, forming a staphyloma.

7. DIAGNOSIS.

Until the active agent of Trachoma is definitely discovered, the diagnosis must depend upon the clinical symptoms. Owing to the fact that the clinical picture of the disease is so varied, the more so, because it is often obscured by superadded infections, it is not surprising that even amongst authorities considerable differences of opinion sometimes exist. For the same reason, mistakes are not infrequently made, either in diagnosing Trachoma when it does not exist, or in not diagnosing it when it does exist. This is well illustrated by Axenfeld[1] from his own experience. He successfully infected his own eye with material from a non-trachomatous follicular conjunctivitis, which had occurred amongst the inmates of an orphanage. After an incubation period of ten days, follicles began to form, both in the upper and lower fornices of the eye, and three weeks later the second eye became infected. He was unable to identify any organism. Three months after infection, when the condition was at its height, he showed himself at the Heidelberg Congress, where Hirschberg, von Hippel and Vossius were unanimous in declaring him to be suffering from Trachoma and advised vigorous treatment. As the symptoms were only trifling, he left the condition as much as possible untreated. After a period of 18 months, the conjunctiva was apparently normal, proving that it had not been Trachoma.

1 Axenfeld. loc. cit.

The diagnosis of Trachoma in its different stages will now be considered.

Trachoma I.

In this stage, the chief distinguishing feature is the presence of small immature granulations, situated in the upper fornix and in the upper part of the conjuntiva tarsi of the upper lid. This is associated with slight papillary hypertrophy, giving the conjunctiva at the upper border of the tarsus a velvety or sand-paper appearance. Though this is very suggestive of Trachoma, it is not absolutely diagnostic. As we have already pointed out, a similar pathological condition may arise from other causes. The differential diagnosis of Trachoma in this stage depends, therefore, on the subsequent course of the condition and its response to treatment. If it is Trachoma, it will soon pass into the second stage, and the response to treatment will be slow; if it is not Trachoma, it will begin to clear up after a few days' simple treatment, and no trace will be left.

Trachoma II.

In Trachoma in the second stage, there are two outstanding diagnostic symptoms, (1) the granulations or follicles, (2) pannus. Without the presence of one of these, the disease in this stage cannot be diagnosed.

(1) Granulations. There is always associated with the granulations a varying amount of papillary hypertrophy, which may be so great in amount as to obscure the granulations, though they are present in every case. The typical Trachoma granulation is a rounded, translucent, greyish-white body, showing sometimes superficially in the

conjunctiva, and sometimes being more deeply embedded in the inflammatory tissue. The granulations, which are about the size of a millet seed, are usually discrete, but in the later stage they frequently fuse together, forming typical gelatinous-looking masses. They occur chiefly in the upper fornix and in the upper conjunctiva tarsi. Such typical granulations are pathognomonic of Trachoma.

There are, however, other forms of conjunctivitis in which granulations or follicles are found, and which need to be differentiated from Trachoma.

The chief of these is follicular conjunctivitis, a disease which affects children of the school age, especially those living in institutions, the inmates of asylums, etc.. A great deal has been written on the differential diagnosis of Trachoma and follicular conjunctivitis. They were formerly looked upon as one and the same disease, follicular conjunctivitis being one of the early stages of Trachoma, and even today they are not infrequently confused. In follicular conjunctivitis, the follicles or granulations, though histologically practically identical with those of Trachoma, are smaller and more transparent. They do not tend to run together, they are more superficial in the conjunctiva, and they are always most frequent in the lower fornix and the lower conjunctiva tarsi, where they are typically arranged in rows. The papillary hypertrophy representing the reaction of the adenoid layer is very much less than in Trachoma, and the tarsus is not infiltrated with inflammatory tissue. In doubtful cases, the ultimate diagnosis again must depend

on the course and treatment. Follicular conjunctivitis in its course presents none of the complications nor sequelae of Trachoma, such as pannus, ptosis, entropion, etc. It has a spontaneous tendency towards recovery, without any of the resulting cicatricial changes which are always seen in Trachoma. It readily responds to simple treatment. Uncomplicated follicular conjunctivitis is a rare disease in N.India. I have seen only three or four instances of this disease, Europeans being affected in each case.

Similar follicles are also occasionally seen in other varieties of conjunctivitis, especially after the acute symptoms have abated. Follicles may also appear on the conjunctiva after the prolonged use of certain drugs, including atropin, eserin and unguentum hydrargyri oxidi rubri. These can all be differentiated from the granulations of Trachoma by their undergoing complete involution without the formation of cicatricial tissue.

The peculiar papillary growths of spring catarrh have also to be differentiated from the Trachoma granulations. In spring catarrh the papillary growths constitute broad and flattened prominences, which may be packed together to resemble cobble stones. They are situated on the conjunctiva tarsi of the upper lid, but do not invade the fornix. The milky-white appearance of the thickened conjunctival epithelium covering them, at first sight, might suggest cicatricial tissue, but, on closer examination, its bluish-white uniform appearance is very different from the cicatricial scars and bands of Trachoma. When the bulbar conjunctiva is at the same time affected with typical gelatinous nodules situated round the limbus, Trachoma can be excluded. In spring catarrh, the enlarged papillae on microscopic examination resemble small fibro-

mata. When eventually they disappear, they leave no trace of their former existence. The presence of an excess of eosinophile cells in conjunctival smears, especially if associated with eosinophilia in the blood, is a diagnostic sign in favour of spring catarrh.

(2) Pannus, which occurs in about one-third of all cases of Trachoma in its different stages, is a diagnostic symptom of great value. In the great majority of cases, it starts at the upper limbus and spreads down, like a veil, over the cornea, with a straight, free lower edge. It is differentiated from interstitial keratitis and healing corneal ulcers by the large superficial blood-vessels which spring from the marginal loops and radiate in from round the limbus. A form of pannus, known as eczematous pannus, is sometimes seen in scrofulous children. It has none of the regular appearance of trachomatous pannus, and may be situated in any part of the cornea. It is associated with other local symptoms, phlyctenular conjunctivitis, fascicular keratitis, etc., as well as with general symptoms of the scrofulous diathesis. It is sometimes seen complicating Trachoma, in which case it may be impossible to tell definitely whether the pannus is eczematous or trachomatous. After pannus trachomatosus has resolved, it usually leaves evidence of its previous existence in the shape of small pits at the margin of the cornea. These result from the cicatrization of Trachoma granulations.

Trachoma II with marked papillary hypertrophy may resemble other forms of conjunctivitis, especially in the chronic stage following repeated acute attacks. If the papillary hypertrophy is so excessive as to obscure the Trachoma granulations, in the absence of pannus it may be impossible to differentiate between them. In such cases, the

diagnosis will depend on the subsequent course and the result of treatment.

In many of the more advanced cases of Trachoma II, the clinical picture presented by the patient leaves no doubt as to the diagnosis. The marked ptosis and photophobia, the thickened and oedematous lids, the granulations and papillary hypertrophy, the thickened folds of the upper fornix, and pannus present a combination of symptoms which is seen in no other form of conjunctivitis.

Trachoma III and IV.

When the stage of resolution has commenced, Trachoma is readily diagnosed. We have seen that no other form of conjunctivitis characterised by the presence of granulations or follicles resolves by the formation of scar tissue . Any disease of the conjunctiva, therefore, in which there are present granulations, whether discrete or fused into gelatinous masses, which are undergoing resolution by the formation of fine bands of cicatricial tissue, must be Trachoma. Though cicatrices may result in the conjunctiva from other causes, such as burns or pemphigus, these are hardly likely to be confused with any of the stages of cicatrization already described as occurring in the resolution of Trachoma.

The various complications and sequelae common to these stages help to confirm the diagnosis.

Acute Trachoma, in our opinion, is Trachoma complicated by an acute superadded infection. Though for the time being the symptoms may be masked by the secondary infection, the subsequent course will reveal the true nature of the disease.

Until the active agent is isolated, microscopic examination of the discharge cannot be said to materially help in the differential diagnosis of Trachoma.

8. PROGNOSIS.

There is a general consensus of opinion that Trachoma, at the present time, is much milder than it was at the beginning of last century, in the epidemics following the Napoleonic wars; but if we exclude the part played in these epidemics by the gonococcus, there is no evidence of this being the case. In India today, Trachoma, as regards its course, duration and ultimate results, is a very serious disease. It causes a great deal of suffering, it frequently interferes with vision, rendering large numbers of people incapable of earning their living, and in many cases it results in the total destruction of sight.

We have seen how the family and community life of an Indian village fosters Trachoma, so that,once it has a hold, its natural tendency is to spread; and under existing social conditions, it will be very difficult to eradicate.

Prognosis of Trachoma I.

In this early stage, the prognosis is good, provided that proper treatment be adopted. The further course of the disease is cut short, and it passes through the third to the fourth stage without any resulting deformity. Rarely, such early cases spontaneously cicatrize and result in a cure, but in the great majority of them the disease, if untreated, steadily progresses, and passes into the second stage.

Unfortunately, the symptoms caused by Trachoma I are so slight as hardly to attract the patient's attention, so that these cases practically never come for treatment until a later stage, when the prognosis is correspondingly worse.

Prognosis of Trachoma II.

The prognosis of Trachoma II in India is bad, as regards both the

immediate effect of treatment and the ultimate result of the disease. Patients in India frequently come from long distances. They have great faith in the English doctor, and they are confident that he can work miracles. They are persuaded to come back for a few times, but they soon lose confidence, owing to the slow progress of the cure, and return to their homes and village "hakīm", without having received any permanent benefit. Generally speaking, the ultimate prognosis is worse the greater the inflammatory reaction, as characterised by the number of granulations and the amount of infiltration of the adenoid tissue of the conjunctiva and of the tarsus. If the disease is complicated by pannus, corneal ulceration, iritis, etc., the ultimate prognosis is also more serious.

It follows from what has been said above that the majority of the cases of Trachoma II are left to run their own course, and sooner or later, they pass into the third stage.

Prognosis of Trachoma III and IV.

The prognosis of Trachoma in the third stage depends on the amount of pre-existing hypertrophy of the conjunctiva, the degree of infiltration of the tarsus, and the corneal complications. Those cases which have run a mild course in the early stages, with little hypertrophy of the conjunctiva, few granulations, and little involvement of the tarsus, may resolve without any deformity as the result of the contraction of the cicatricial tissue. In these, the ultimate prognosis is good. In the more serious cases, on the other hand, with marked inflammatory reaction and infiltration of the tarsus, the scarring which results in the process of resolution is so great that a certain degree of deformity is almost certain to follow. The prognosis here is bad. Entropion

and trichiasis cause irritation of the cornea, which may result in ulceration and permanent impairment of vision. In the worst cases of all - xerosis conjunctivae - when the whole of the conjunctiva becomes transformed, the prognosis is hopeless.

The prognosis of Trachoma in any of its stages is also affected to some extent by the general constitution of the patient, as well as the social conditions in which he lives.

Superadded infections, with the gonococcus, Koch-Weeks bacillus, etc., frequently cause exacerbations of the disease, so delaying its course and making the prognosis worse.

9. TREATMENT & PROPHYLAXIS.

Trachoma is cured, for the most part, by the laying down of new fibrous tissue, which either replaces the granulations and hypertrophied papillae, or entraps them in its meshes, causing them to disintegrate and become absorbed.

The general indications for the treatment of Trachoma are:-

1. To alleviate painful symptoms and to check discharge.
2. To limit the hypertrophy of the conjunctiva and the inflammatory infiltration, and so cut short the course of the disease.
3. To promote cicatrization.
4. To conserve vision by active treatment of corneal complications, and by correcting deformities which are likely to injure the cornea.

The indications for treatment in the different stages will be briefly considered, after which, some of the more modern remedies and more elaborate methods of treatment will be discussed.

Trachoma I.

The indications for treatment in this stage are to check the secretion and to bring about the resolution of the Trachomatous material. The secretion is infectious, and the checking of it will prevent the spread of the disease. If it is great in amount, it is usually the result of a mixed infection.

It is possible that in the very early stage the immature granulations may become absorbed and leave no trace of their previous existence. The routine treatment adopted by us in all early cases is first of all the daily instillation of a 1% or 2% solution of silver nitrate, until the discharge ceases. The small granulations and hypertrophied tissue of the upper fornix and upper conjunctiva tarsi are then lightly

touched with a copper sulphate stick, at first once a day, then twice a week. The treatment is painful, but if the patient persists, the granulations are gradually replaced by new fibrous tissue, and the fornix becomes pale and smooth. Failure of this treatment in the first stage is rare, and is almost invariably due to the patient, once the subjective symptoms have gone, refusing to continue it any longer.

Trachoma II.

The treatment varies according to the pathological condition of the conjunctiva. We have to remember in all these cases that the hypertrophy of the conjunctiva has a definite wave length, advancing to a certain stage, and then gradually subsiding by the formation of cicatricial tissue.

The indications for treatment are to stop the secretion, to alleviate painful symptoms, and to assist, and imitate as far as possible, nature's cure.

The treatment in this stage is a long and tedious process, the course of the disease being subject to relapses, and exacerbations, caused chiefly by super-added infections, and unless the patient is warned early, there is little chance of his persisting in it. In the majority of cases, the silver nitrate and copper sulphate treatment plays a large part.

The combination of blue stone and lunar caustic in the treatment of Trachoma has been in common use for many years. Vetch,[1] in 1820, after condemning many of the more drastic methods of treatment, such as scarification, excision and ligature, declared a preference for silver nitrate, copper sulphate and similar remedies, and professed to get excellent results from them. In 1824,

[1] Vetch, loc. cit. (treatise) p. 204.-230

O'Halloran, an Army surgeon, applied them in the following way. The patient was kept in bed on low diet, with frequent purging. Blue stone was rubbed over the conjunctiva of the lids, and the application was followed by fomentations. Ten grains to the ounce of silver nitrate in the form of drops was applied every morning. Writing of his results, he states:- "It is astonishing how quickly the state of the eyelid denominated granular is removed by the blue stone, if the subject be not of scrofulous habit, or the eyelids spongy, watery, or covered with fatty dry lumps. In the latter case, the knife will be necessary for the removal of the tumours, after which a solution of blue stone will complete the cure. The case in question is the only one in which, in my opinion, the knife is admissible to the internal surface of the eyelids."[1]

Silver nitrate is most useful in those cases with a free discharge and marked papillary enlargement, with injection of the vessels of the bulbar conjunctiva. It may be used in varying strengths, but for general use a solution of more than 2% is not recommended. It is best applied by painting the conjunctiva of the everted lid and fornix with a brush, or cotton wool on the end of a probe, moistened with the solution, the excess being washed off by saline. This should be done daily. Solutions up to 10% have been used by us, but though the immediate action on the hypertrophied tissue in some cases is more rapid, there is a danger that excessive scarring may result. Lunar caustic stick for the same reason should not be used. There is a great tendency, especially when it is known that the patient will not submit to a prolonged course of treatment, to try and bring about a

1. Stephenson, loc. cit. p.132.

speedy cure by strong and vigorous remedies, whether they be chemical, mechanical or operative. Though marvellous results occasionally follow such treatment, as a general rule, and especially in unskilled hands, they are to be strongly condemned, because the scarring which follows may lead to deformities, the ultimate result being worse than the disease.

Boldt,[1] writing of the use of silver nitrate, states that "an astringent rather than a caustic effect is to be aimed at," and of the copper stick, "The fundamental principle is not to cauterize, but to stimulate." In other words, we must in our treatment assist nature, in, as far as possible, simulating her methods of cure by the laying down of fine bands of connective tissue. After the application of silver nitrate, a white film forms over the inflamed conjunctiva, due to the coagulation of albumen. MacCallan[2] explains the resulting action thus:- "A transudation from the blood-vessels occurs under the coagulum, which is thrown off, containing the superficial epithelial cells and conjunctival bacteria." Under this treatment, the discharge soon diminishes in amount, the conjunctival swelling is reduced, and the granulations which were hidden by the papillary hypertrophy become more prominent. We have now reached the stage when the proper application of the copper stick will give its best results. The surface of the stick must be perfectly smooth. It is carried once or twice lightly over the conjunctiva of the everted lid and fornix. At first this requires to be done daily. Its action on the tissues is not definitely understood. It probably acts partly as a stimulant, causing a mild inflammation with leucocytosis in the superficial layers, and partly as an astringent, promoting absorption of the inflammatory tissue.

1 Boldt, loc. cit. p. 173
2. MacCallan loc. cit. p. 37

Eventually, fine cicatricial bands begin to appear in the conjunctiva, the fornix becomes paler, and the disease passes into the third stage. The time taken over this varies greatly; in favourable cases, it is usually about one month.

In the later stages of Trachoma II, where the discharge is scanty and the granulations are the most prominent feature, and more especially where they are fused together into gelatinous masses, the preliminary treatment with silver nitrate is not required. The most satisfactory result in these cases may be obtained by copper sulphate, preceded by some form of mechanical or operative treatment. A great variety of methods are at our disposal. The following two are most frequently used by us, and give good results.

1. After anaesthetising the patient or rendering the conjunctiva insensitive with cocaine, the eyelid is everted and the fornix exposed. Any superficial granulations or gelatinous masses are expressed by the fingers, or picked off with forceps. The conjunctiva is then rubbed fairly vigorously with cotton wool dipped in some antiseptic, usually perchloride of mercury, 1 in 1000 or 1 in 2000. Bleeding ensues, and may be controlled by adrenalin solution. During the process of rubbing, the superficial granulations are evacuated, and the antiseptic reaches all parts of the conjunctiva. Without any serious damage to the tissues having been done, a mild reaction is set up, which results in a leucocytosis and stimulates the absorption of the inflammatory material. This treatment may be repeated two or three times, if necessary. After a few days, it is followed by the application of the copper stick.

2. Instead of simple friction, better results are sometimes obtained

by the following more vigorous methods. Under a general anaesthetic, any areas of gelatinous-looking tissue or superficial granulations are gently curetted away with a sharp spoon, or they may be scarified with a scalpel and removed with a small spoon. If granulations are present in the fornix, they are expressed between the blades of Grady's forceps. The blades grasp the protruding fornix as far up as possible, and are then gently drawn away, rupturing any granulations in their course. This is repeated several times. Throughout the operation, great care must be taken not to cause excessive laceration of the tissues. In preference to this, it is better to repeat the operation. Kuhnt,[1] of Bonn, condemns the use of Grady's forceps as causing too much tearing and bruising of the tissues. He uses his own expressor, which consists of two blades, one of which is perforated. The eyelid is everted, and a number of punctures are made in the hypertrophied tissue. The lid is then grasped between the two blades, the perforated blade resting on the conjunctiva. The blades are pressed together with considerable force, and the tissue is expressed through the perforations. After the inflammatory reaction resulting from the operation has subsided, the treatment with the copper stick is employed.

In place of the copper stick, MacCallan[2] strongly recommends the use of a 1% solution of perchloride of mercury. Immediately after curetting and expression of the granulations, the perchloride is applied to the bleeding conjunctiva. The application is repeated daily, and he states that after a fortnight's treatment the commencement of the change into Trachoma III should be observed, and at the end

1 Kuhnt, the Treatment of Trachoma, (abridged translation) Ophthalmoscope, Vol. 13. 1915. p. 150

2. MacCallan, loc. cit. p. 33.

of a month the process of cicatrization is definitely established. This method has been used by us, but the results obtained were not better than those which we previously got from the use of copper sulphate, though in some cases it seems to be an advantage to alternate the treatment.

Many other medicinal remedies have been tried, but in our hands none of them have proved to be better than the above, and they need not therefore be considered here. The more radical operative treatment and its indications will be dealt with later. Trachoma II is frequently complicated by other infections. Until the superadded infection has been dealt with, no operative treatment for the trachomatous condition should be undertaken.

Trachoma complicated by a gonococcal infection is best treated by a daily use of a 2% solution of silver nitrate. In addition to this, the eye should be repeatedly bathed with a simple antiseptic, and the other eye, if not infected, should be protected with a shield. The application of silver nitrate is also the best treatment for infection with the Koch-Weeks bacillus. Zinc sulphate in ½-1% solution readily controls the inflammation caused by the Morax-Axenfeld bacillus.

Trachoma III.

In this stage, resolution of the trachomatous tissue has begun. In some of the cases, the disease will have passed into the third stage as the result of treatment; in others, it will be seen as Trachoma III for the first time.

The indications for treatment are to promote cicatrization and to avoid relapses. In many of the cases, the continuation of

the treatment with the copper stick is all that is required. At first, it is applied daily, but when the formation of new fibrous tissue is well established, one application every second day is sufficient, and later on it may be used once or twice a week. Finally, if the resolution is progressing satisfactorily, it is diluted, and used as a lotion or an ointment. Even after the cicatrization is complete, it is advisable to continue to use a simple astringent containing dilute copper or zinc sulphate. In many of the cases that have not been previously treated, where there are disintegrating masses of tissue, preliminary treatment by curetting and expression, as described under Trachoma II, will greatly shorten the process of resolution.

Simple pannus as seen in both the second and the third stage of Trachoma requires no special treatment. It will retrogress as the condition of the conjunctiva improves. If the corneal stroma has been invaded, a permanent opacity will result. The treatment of corneal ulcers and of iritis in Trachoma is the same as when they result from other causes, and requires no special mention.

Trachoma IV.

In this stage, the trachomatous tissue of the conjunctiva has been all replaced by fibrous tissue. It may be the result of treatment or nature's cure. In slight cases, it may follow after six months; on the other hand, in severe cases it may not follow in a lifetime. No special treatment is required.

Meyerhof[1] of Cairo has proved that a previous attack of Trachoma does not confer immunity. He has observed a fresh infection in over 40 cases where the conjunctiva had cicatrized as the result of former

[1] Meyerhof. Ophthalmoscope. Vol 13. 1915. p. 152.

attacks of Trachoma. If the whole of the conjunctiva, therefore, has not been replaced by cicatricial tissue, it is wise to continue treatment with a simple astringent to prevent re-infection. Myerhof also points out,as the result of the above observation, that serotherapy is not likely to be of value in the treatment of Trachoma.

In considering the treatment of Trachoma in India at the present day, two things must be remembered: first, the widespread nature of the affection, and,second, the medical attendance available.

In North India, we have estimated that 40% to 50% of the people are infected. The number of doctors is very small, and not all of the Hospital Assistant class are capable of carrying out elaborate treatment. Under these conditions, the best general results will be obtained from that treatment which does not require too much technical skill, and which results in a reasonably speedy and permanent cure. In the above outline of treatment, we have kept these points steadily in view.

In those cases which resist the ordinary methods of treatment, and more especially in those where the inflammatory infiltration has invaded the tarsus to a considerable extent, more radical operative treatment is necessary, to bring about a cure within a reasonable time.

A medical thesis is not the place to discuss in detail the various operative measures used in the treatment of Trachoma. There are, however, three operations in common use at the present time, which, both in shortening the course of the disease and in preventing deformities, have been proved to give good results. These operations

require greater skill, and should not be undertaken without special training. Their indications and technique will now be considered.

1. Excision of the upper fornix.

This operation, the simplest of the three, is indicated under the following circumstances:-

(i) When the trachomatous condition has resisted the previous methods of treatment;

(ii) When the disease is confined chiefly to the fornix, and the tarsus is not infiltrated to any extent;

(iii) When persistent pannus complicates the above condition;

(iv) When the patient has not the time to undergo the simple and more protracted treatment.

Under a general or local anaesthetic, the upper eyelid is everted and the fornix is protruded. A ligature is passed through the mucosa at each end of the protruding fornix, and the fold is then drawn away from the lid by the two ligatures held by an assistant. An incision is now made just beyond the transition folds in the bulbar conjunctiva. A second incision, connecting with the first, is made along the upper border of the tarsus. The wounds now gape under tension, and the diseased fornix is separated from the underlying tissue and removed. The cut edge of the bulbar conjunctiva is sutured to the upper border of the tarsus. During the operation, the haemorrhage is free. The insertion of the levator palpebrae superioris muscle into the tarsus must be carefully avoided. If damaged to any extent, ptosis will result. The wound readily heals, without much scarring.

2. Combined excision of the tarsus and conjunctiva.

When the tarsus is seriously involved, the inflammatory condition

of the conjunctiva and pannus are much more resistant to simple treatment. These are the cases affording the chief indication for this operation. If the bulbar conjunctiva is involved, the operation cannot be performed. It is also very difficult if the upper fornix is soft and friable. The presence of commencing entropion or corneal complications, is a further indication for the operation. Briefly, it is performed as follows:-

The first incision is made as in the excision of the upper fornix. The conjunctiva alone is cut through, and is dissected back a little way from the underlying sclera. The second incision is now made through the conjunctiva, parallel to and about 3 mm. from the free margin of the lid, which is everted on a spatula. The ends of this incision connect with those of the former. The incision is carried down through the tarsus, care being taken to leave a strip of the cartilage at the ciliary margin of the lid. This strip is seldom involved with inflammatory infiltration. The tarsus is now carefully dissected upwards from the overlying tissue, until its upper border is reached. The tendon of the levator muscle is divided at its insertion into the tarsus. The separation of the tissues in the fornix is now completed, and they are removed complete with the tarsus. The success of the operation now depends on securing a good approximation of the upper free conjunctival border to the tarsal strip left at the ciliary margin. The sutures drawing the divided edges together are passed in through the skin and tied on the outside. A sterile vaseline dressing is applied. The sutures are removed on the third or fourth day, and the treatment with mild astringents is continued. This operation in picked cases gives excellent results.

The whole diseased area is removed, thus bringing about a radical cure, without risk of a relapse. After excision, pannus rapidly clears up, and the development of entropion with its train of corneal complications is avoided. If the operation is unskilfully performed, the complications resulting from ptosis, deformity of the lid, and excessive scarring of the wound are very grave.

3. Excision of the tarsus.

In this operation, introduced by Kuhnt, the diseased tarsus is removed, whilst the overlying conjunctiva is left. The operation is indicated in the later stages of Trachoma, when the process of cicatrization of the conjunctiva is practically completed, but the tarsus remains thickened and distorted.

An incision is made just above the free border of the everted lid, as in the combined operation. The conjunctiva is separated from the tarsus. The tarsus is then cut through and dissected from the overlying tissues, as described in the previous operation.

In a paper recently published, Suker[1] of Chicago has reviewed these last two operations. According to him, the risks of the operation when the tarsus is excised are:-

(1) entropion from contracting granulation tissue,

(2) loss of the contour of the lid,

(3) the development of lagophthalmos,

(4) ptosis from damage to the levator muscles.

He gives the following indications for the operation:-

1. Any case of Trachoma which does not yield to usual treatment.

2. Any case in which the tarsus is extensively involved, and its

1. Suker The Excision of the Tarsus in Trachoma, Archives of Ophthalmology. Vol. XLVI. 1917, p. 210.

surface is uneven and studded with small nodes which constantly irritate the cornea, causing a persistent pannus.

3. Any case in which the tarsus is incurved, pressing on the cornea, and causing ulcers and vascularisation at the limbus.
4. Any case in which the tarsal conjunctiva is velvety and infiltrated with exuberant trachomatous tissue.
5. Any case in which the upper half of the cornea is frequently subjected to ulcers.
6. Any case in which pannus does not subside in a satisfactory way.

The operation is not indicated if the cornea is not extensively involved. The presence of corneal ulcers, in his opinion, is not a contra-indication, but rather an indication for operation.

Other Methods of Treatment.

Some other methods of treatment in use at the present time will now be discussed.

CO_2 Snow.

The treatment of Trachoma with CO_2 snow has been in common use in India for some years, and in many cases it gives very satisfactory results. Care must be taken that the applications are not too long nor too frequent, otherwise excessive scarring results. Also, neither the snow nor the frozen lids must be allowed to come into contact with the cornea. Montagu Harston[1] of Hong Kong, who has had a large experience of this treatment, strongly recommends it. He has treated over 7000 cases in this way, and claims uniformly successful results. In his opinion, it constitutes the most rapid

1. Harston, The Treatment of Trachoma by CO_2 snow. Ophthalmoscope Vol. 12. 1914. p. 654.

method of cure, when employed with other recognised methods, such as the maintenance of cleanliness, expression of the granulation, etc.. His method of procedure is as follows:- The snow is collected in a Prana cage and rammed down tightly into a cylindrical mould. The end is suitably sharpened. The conjunctiva is anaesthetised with cocaine and adrenalin. The lids are everted, and the fornices are made to project prominently. The surgeon stands behind the patient and applies the snow pencil horizontally to the conjunctiva, with very firm pressure. The first application lasts for 15 seconds, and all subsequent ones for 30 seconds. After an interval, the lids are replaced. The treatment is repeated after 14 days. Those cases with papillary hypertrophy take the longest time to cure. The pain resulting from the application is not severe, as compared with that caused by the copper stick. The CO_2 acts by inducing a chronic hyperaemia of the conjunctiva, in the same way as Bier's bandage acts when applied above a joint.

Subconjunctival Injections.

The treatment of Trachoma with subconjunctival injections has aroused considerable controversy in India during recent years. It is used most frequently for the treatment of pannus and corneal opacities, but also for Trachoma of the conjunctiva. Following the injection, an inflammatory reaction is set up. The treatment was evolved in the following way. The influence of an acute inflammatory attack in clearing up pannus and corneal opacities has long been observed. Vetch records a case where a dense leucoma vanished and the patient saw again, just as he was killed by the fever of pulmonary tuberculosis. [1] Following this, from 1830 to 1870, the

1. Stephenson, loc. cit.

inoculation of the eye with the discharge from cases of purulent ophthalmia and blennorrhoea was frequently employed in the treatment of chronic complications of the cornea. How disastrous the results must have been in some cases we can well imagine.

An infusion of jequirity seeds or "prayer beads" had for some time been in common use in Brazil in the treatment of eye diseasea The active agent in the infusion is a toxic substance called abrin, which, when applied to the conjunctiva, produces a severe inflammation similar to gonorrhoeal ophthalmia. The result of the ophthalmia was in many cases a reduction of the corneal opacities and an improvement in vision. Great discussion followed its use, and finally it had to be abandoned, because the severity of the inflammation could not be gauged nor regulated. Roemer[1] overcame the difficulty by obtaining a constant solution of abrin, the active toxin. He prepared definite dilutions of the toxin, and also through experiments on animals produced a specific antitoxin. In this way he was able to limit the amount of the inflammatory reaction. Mild solutions of this remedy, which is known as jequiritol, are first used, in case the conjunctiva be very sensitive. If no reaction takes place, stronger solutions are instilled. A satisfactory reaction is obtained, if, a few hours after the instillation, signs of ophthalmia commence. The conjunctiva and lids become swollen, the discharge is free, and membranes develop on the conjunctiva tarsi. The inflammation reaches its height in 24 hours, and then begins to decline. In selected cases of pannus, the cornea may clear up in a remarkable way. A very similar action, it was argued, could be obtained by the subconjunctival injection of certain chemicals under the bulbar conjunctiva.

1. Roemer. Text-book of Ophthalmology (Translation by Foster) London. 1912. Vol 1. p. 164.

Lieut.-Col. Smith,[1] I.M.S., is a great advocate of this treatment. The solution for injection recommended by him is a 1 in 4000 solution of cyanide of mercury, and he claims that it exerts a powerful influence over not only Trachoma of the cornea, but also of the conjunctiva of the lids. The eye is previously well cocainised, and the patient is given a hypodermic of morphia, as the pain at the time of, and for some three hours after, the injection is severe. Twenty minims of the solution are slowly injected beneath the upper part of the conjunctiva bulbi. It works its way round the limbus and causes ballooning all round. After about three hours, oedema of the eyelids sets in, and the pain partly subsides. The oedema disappears in seven days. The reaction set up is essentially the same as that following the instillation of jequiritol, the advantage being that with the mercury cyanide the reaction is more standard. Three or four injections are usually enough for most obstinate cases of Trachoma or pannus. The solution, according to Smith, acts as a direct poison to the Trachoma organism, and also on the principle of Bier's treatment.

Smith's methods and results were strongly criticised by Lieut. Col. Elliot,[2] I.M.S. Elliot experimented on six patients, who were suffering from Trachoma of both eyes. One eye was treated by Smith's method, the other by expression, silver nitrate, etc.. Two patients were given one subconjunctival injection each. In one, the result of the injection was a grave aggravation of the pannus; the granulations did not disappear, and ptosis followed. In the other, the conjunctival reaction was so severe as to lead to dense scarring. One patient had two injections. They caused great suffering, and

1. Lieut. Col. Smith Subconjunctival Injections .... in Trachomatous Conditions
Indian Medical Gazette. Vol. XLV. 1910. p. 295

2. Major Elliot The Treatment of Granular Ophthalmia etc.
Indian Medical Gazette, Vol XLVI. 1911. p. 343.

exerted an unfavourable influence on the pannus, the pannus becoming more vascularised. Ptosis also followed. One patient had three injections, but was not cured. Two patients had four injections each; one of these was kept under observation for two months, and at the end of that time the eye treated with cyanide of mercury still showed granulations, whilst the other eye was cured by roller forceps,etc.. The last case was under observation for six months, when the condition had improved.

From his experiment, Elliot concludes that cyanide of mercury injections have no specific influence on the granulations of the palpebral conjunctiva, also that their influence on pannus and other corneal conditions is not altogether favourable, being much less beneficial and safe than a careful peritomy. Grave objections to the treatment are the severe pain and the liability to ptosis, due to paresis of the levator palpebrae superioris muscle.

Subconjunctival injections have been used by us in a number of cases,with varying results. In case No.24, already referred to, the right cornea was covered almost completely with a thick fleshy pannus, which obscured the pupil. The conjunctiva of the lids showed gelatinous and inflammatory areas. On Dec.12th.,1914, the patient was given a subconjunctival injection of 1 in 4000 cyanide of mercury. Severe pain lasted one hour. On Dec.14th. the pannus had partly disappeared. On Dec.18th., the pannus, except at the upper limbus, had lost all its thick fleshy appearance, and the pupil and iris were then clearly visible. The conjunctiva tarsi was smoother and paler.

We are not convinced that the results from using cyanide of mercury are appreciably better than those got from using normal

saline in the same way. Injections may also be made ~~direct~~ under the conjunctiva of the lid, just beyond the limit of the tarsus.

Dr. Joseph Rudas[1] of Budapest strongly advocates the use of Iodic Acid. The iodic acid is prepared as follows:-

"Acid Iodici gtt. viginti

Gummi Arabici or aquae distill. qu. sat. ut fiant bacill. No.III."

Acoin may also be added to diminish the pain after treatment. After the conjunctiva is anaesthetised, the inflamed tissue is cauterised with the above solution. The follicles appear yellow. A violent inflammation follows, and the parts destroyed by the acid are cast off. The cases specially adapted for this treatment are those where the discharge has ceased and the inflammatory symptoms have subsided. Rudas claims by using iodic acid to considerably shorten the period of treatment, and to reduce the number of complications and relapses.

Radium, electrolysis, X rays, high frequency currents and light have all been used in the treatment of Trachoma.[2] We have had no experience with any of these, nor are they likely to prove of any material value in solving the problem of the treatment of Trachoma in India.

Tattooing with indian ink of dense white leucomata which resist all treatment has frequently been resorted to by us. If carefully performed, there is little risk of setting up inflammation. The cosmetic effect is certainly good.

The Treatment of Entropion and Trichiasis.

The commonest complications of Trachoma which present themselves

1. Rudas The Treatment of Trachoma by Iodic Acid (trans. Lehrin) Archives of Ophthalmology. Vol. XLII 1913. p 494.

2. Harman loc. cit. p. 189-194.

for treatment are entropion and trichiasis. The patient does not as a rule come for treatment until the deformity has reached an advanced stage and he has proved to himself that pulling out the eyelashes relieves the irritation for a few days only, after which it makes the condition worse. The cornea is frequently affected with old pannus, opacities and active ulcers. If untreated, the eye will eventually become blind from dense opacity of the cornea, or from any of the complications associated with active ulceration, such as prolapse of the iris, iritis, staphyloma, etc.. The only remedy is an operation which will correct the deformity and so remove the irritation caused by the pressure of the incurved lids and the sweeping of the eyelashes on the cornea. An operation should be performed, even if at the time there is practically no vision in the eye. Associated with this, and brought on by the painful condition of the cornea, there is frequently a spasm of the orbicularis, the margins of both lids being folded in and the eye kept tightly shut. Shortening of the palpebral fissure, seen in advanced cases, also exaggerates the condition. If the eye is discharging freely, or the conjunctiva is acutely inflamed, a few days' preliminary treatment with silver nitrate should be carried out before operating.

The operation I have usually performed is a modification of those described in all text-books on the subject. Under general anaesthesia, the lid is everted and supported by a loosely applied entropion clamp or spatula, and an incision is made along the free border, just posterior to the eyelashes, care being taken to avoid their roots. This is sometimes difficult, owing to the irregular distribution of the eyelashes and the rounding off of the well defined posterior margin of the free edge of the lid which occurs in entropion. If

any hairs are cut through, the roots must be carefully enucleated. The incision is made about $\frac{1}{12}$ th. of an inch deep. Another incision is now made in the skin along the front of the eyelid, parallel to the lid margin, and about $\frac{1}{6}$ th. of an inch above it. The lower border of the orbicularis muscle is dissected up, and the incision is deepened until it connects with the first. We now have a strip of tissue containing the eyelashes, freed from the rest of the lid, except at its outer and inner end.

If the skin over the upper lid be redundant, a small elliptical shaped portion may be removed with some of the underlying tissue. The sutures are now introduced, horsehair or fine silk-worm gut being used. Starting above, the needle is passed from without inwards through the upper free skin edge and the superficial surface of the tarsus. It is now carried down behind the freed strip and passed through its posterior edge, just behind the eyelashes. The ligature is then tied in front. In this way, the freed strip bearing the eyelashes is not only carried up in front of the lower border of the lid, but also everted. If the conjunctiva of the lid has not completely cicatrized, the eyelashes are transplanted further up the lid, so that in the process of cicatrization the deformity may not recur. If the tarsus is thickened and incurved, a wedge-shaped portion is removed from the front of it. The sutures which are introduced as above are passed superficially through the tarsus, so as to bring its cut surfaces into apposition. Four sutures are usually required in each lid. They are removed on the fourth or fifth day. A boric ointment dressing is applied, and the bare surface on the lower and anterior

border of the lid quickly heals over. If there is blepharospasm, or marked narrowing of the palpebral fissure, the external canthus is divided, the conjunctiva is undermined, and then drawn up and sutured to the skin wound. This operation is known as canthoplasty.

PROPHYLAXIS.

In a country where such a large percentage of the population is infected with the disease, the prophylaxis of Trachoma is at the same time a serious and urgent problem.

Trachoma is a serious condition for the individual, the family and the Empire. We have seen how, in the individual, the onset of the disease is frequently of such an insidious nature that before the patient presents himself for treatment it has established a firm footing. The treatment is prolonged and painful, and in a poor community very few are able to submit themselves sufficiently long to guarantee a cure. As the disease progresses, the individual is from time to time incapacitated ~~for~~ from carrying on his daily work. Eventually, vision may be interfered with to such an extent that he is unable to earn his living, when he becomes a burden to his family and the community.

Trachoma is serious for the family. One member of the family is affected, and among people living under the crowded and unhygienic conditions which exist in the Indian village home, the disease spreads from one to another. It is inevitable that children who are born in such a home will contract the disease in the early months of their life. The same remarks apply to the Indian village, with its community life.

Trachoma also presents a serious problem for the Empire.

Not only are large numbers of people incapacitated ~~for~~ from working for their living, but an appalling number are rendered blind. The suffering and social misery resulting from this in a poor country is enormous, and the upkeep of those incapacitated is a great economic loss to the community.

This brings us to the consideration of the prevention of the disease. Unfortunately, the prophylaxis of Trachoma presents a very serious problem, and it is not to be wondered at that, so far at least, the British Government has undertaken practically no measures for its solution. The policy of the Government in India has been to do nothing to interfere with the customs of the people, and in no other country in the world are the people so conservative in their habits and customs. But when custom, which too frequently is a mixture of superstition and ignorance, endangers so many, it is time that the problem was faced and its solution at least attempted. Briefly stated, the problem of the prophylaxis of Trachoma in India consists in the education of the family and village community in simple methods of hygiene and cleanliness. When we consider the size of India, and the fact that we are dealing with an uneducated people who for the most part cannot read, we realize that this is no easy matter. The difficulties in the way are almost insurmountable. Things move slowly in India, and the process of education will be very gradual. We do not profess to be able to contribute anything of importance towards the solution of the problem, but with the advance of civilization and education, we claim that it is time that this matter was seriously considered by the Government.

The two most important points that demand consideration in the prophylaxis of Trachoma and contagious ophthalmia generally are:-

I. The education of the people, and

II. The provision of more adequate treatment.

I. In any campaign for the education of the people, the following points should be emphasized:-

1. The fact that the disease is communicated from one person to another by the discharge, and in no other way.
2. The common ways, already referred to, in which such a discharge is conveyed to the eyes of other people in an Indian house or village. The danger of sleeping in the same bed with an infected person, or using the same towel, should be made clear.
3. The importance of cleanliness and the risk of using the water of public tanks etc. which may be infected.
4. The value of fresh air, sunshine,etc.
5. The special risk of a mother suffering from the disease infecting her infant, and the disastrous results that will follow.

Though doubtless many of the conditions favouring the development and spread of ophthalmia in an Indian village are due to poverty, over which we have no control, many others are caused by superstition and ignorance. By educating the people in this way to the danger of the latter, the conditions will gradually be improved.

The education of the people as outlined above should be carried on as far as possible through existing channels. Of these, the first in importance is probably the village school. All villages of any size have schools for the primary education of boys, which are supported by the Government. By this channel the largest number of

households will be reached, and though the teaching may appear to have little influence at the time, in a conservative country like India the soundest principle is to aim at results in the next generation. In secondary schools and colleges, lectures on the subject should form part of the curriculum. The upper classes and educated people could best be reached by the public press and by printed circulars. Simple instructions could also be issued to headmen to be passed on to the people of their respective villages.

II. The provision of more adequate treatment.

The spread of Trachoma is effectively prevented by curing this disease in its earliest stages and by controlling the discharge during exacerbations. The number of dispensaries and hospitals at which such treatment is available at the present time is wholly inadequate; nor is it probable that in the near future it can be materially increased, unless by charitable enterprise. At the same time, when the health and happiness of so many of our fellow-subjects are concerned, it is surely right that the problem be faced, and that some definite policy be adopted by the Government to cope with this scourge. It would be out of place here to outline any such policy, but the work that has already been undertaken by the Government in Egypt should serve as a guide.

10. THE INFLUENCE OF TRACHOMA ON SENILE CATARACT.

This will be discussed under the following headings:-

1. The influence of Trachoma on the etiology of Cataract.
2. The influence of Trachoma on the operation for Cataract.
3. The influence of Trachoma on the end results.

1. The Influence of Trachoma on the Etiology of Senile Cataract.

Even at the present day, little is known as to the etiology of senile cataract. There are still those who hold the opinion that it is a physiological change associated with advancing years. The fact, however, that only a very small proportion of those who live to an old age develop cataract has led the majority to the conclusion that it is a pathological condition. A large number of theories have been advanced to explain the reason for the pathological changes, but so far none of them is convincing. The cause has been sought for, in the lens itself, in a disturbance of the chemico-physical relations existing between the lens on the one hand and the aqueous and vitreous on the other, and also in general conditions affecting the whole body.

Senile Cataract is a very common disease in N. India, where it is quite commonly seen in people at the age of 40. The cause of this has been given as the glare of the sun, the dust, the dryness of the atmosphere and the fact that the people age much sooner. I am convinced that in addition to these things, Trachoma and chronic ophthalmia generally play an important part. Out of a series of 100 patients who presented themselves for the treatment of senile cataract, 43 showed evidence of Trachoma, either past or present.

In the present condition of our knowledge of the pathology of the lens it is not possible to explain the exact influence of a chronic inflammation of the conjunctiva. The following is a possible explanation. Disturbances of the circulation of the conjunctiva, such as occurs in inflammation, react on the circulation of other parts of theeye, and so influence the nutrition of the eye and more particularly of the lens. The vascular disturbance and influence on the nutrition is much greater if the conjunctivitis is complicated, as it frequently is in Trachoma, by keratitis, iritis etc.

2. <u>The influence of Trachoma on the operation of cataract.</u>

Of the 43 cases of cataract showing evidence of Trachoma 28 had reached the stage of healed trachoma and had no deformity of the lids. In these the operation for the removal of the cataract was in no way complicated by the pre-existing trachoma.

Of the remainder, 5 represented a varying amount of trachomatous tissue in the conjunctiva of the lids and had some discharges. These required preliminary treatment, because in all probability the continued discharge was caused by a mixed infection. In such cases the crevices between the papillae and granulations harbour organisms which might infect the operation wound. It is not safe to operate for cataract until the conjunctiva is cicatrized and smooth.

Five others were complicated by entropion and trichiasis and required preliminary operation for the correction of the deformity and the removal of the irritation caused by the eyelashes sweeping over the cornea. In one of the five, in addition, the operation of canthoplasty had to be performed to enlarge the contracted palpebral fissure.

In 4 cases the cornea was opaque in parts as the result of old pannus and corneal ulceration. In two of these, as the pupil was almost entirely obscured and the upper part of the cornea affected, the incision was made downwards and the iridectomy was performed at the lower part. One case was complicated by xerosis, and operation for cataract was out of the question.

3. The influence of Trachoma on the end-results.

If the Trachoma has completely resolved, leaving the conjunctiva smooth & if there have been no corneal complications, the end-results of the operation for cataract will not be affected by the pre-existing Trachoma. In cases recently cured there is some risk, as the irritation caused by the operation, & the binding up of the eye for a few days after, are apt to cause a mild exacerbation, & organisms which have been latent increase & infect the wound.

If pannus has previously existed, according to MacCallan (1), the bloodvessels of the pannus, though they shrink and are invisible to the naked eye, still remain. When the incision of the cornea is made, they fill up with blood & much of the former opacity of the cornea is reproduced: this may clear up after the wound has healed. We have observed in a few cases a diffuse haziness of the upper part of the cornea spreading down from the incision & after a few weeks gradually passing away. This can probably be accounted for in the way just explained.

1. MacCallan, loc. cit. p. 26.

It is well to remember that severe pannus & ulceration of the cornea is often associated with iritis, which, though no pathological condition is visible to the naked eye, is apt to recur after operation & so spoil the end-result.

Osborne of Alexandria & Meyerhof of Cairo were struck with the satisfactory healing of Trachomatous eyes after intraocular operation. In 240 cataract operations they had only 3 infections of the wound resulting.

1. Osborne & Meyerhof, Ophthalmoscope. Vol 13. 1915. p. 201.

(11) TABULATED SUMMARY OF

No.	Name	Sex	Age	Religion	Complaint	History	Stage
1	A.B.	M.	29	C. European.	Burning of eyes and slight discharge.	Gradual onset for last 6 months.	T.I.
2	Miss D.	F.	25	C. European.	Pain in eyes and discharge.	Arrived in India 9 months ago. Symptoms gradually increased.	T.I to T.II.
3	Miss S.	F.	38	C. American.	Pain in eyes, swelling and discharge.	For 2 years has complained of burning and heaviness of eyes. Eyes become bloodshot.	T.II
4	Ramzan	M.	10	M.	Repeated attacks of inflammation.	18 months ago had acute conjunctivitis. Since then recurring less acute attacks.	T.III
5	Ganga Dei	F.	4	H.	Watery discharge from eyes and nose.	Duration 1 year. Eyelids stuck in morning. Sometimes eyes become more inflamed.	T.II
6	Ram Saran	M.	3	H.	ditto	3 months ago had acute conjunctivitis. Gradually subsided, leaving present condition.	T.II.

CASES OF TRACHOMA.

Condition on Examination			Other Complications.	Treatment	Result
Lids	Conjunctiva	Cornea			
No swelling nor ptosis.	Slight inflammation, sand-paper appearance of upper conj. tarsi. Small follicles in upper fornix.	-	-	2% silver nitrate Ung. Hydrarg. Perchlor. 1 in 1000.	Cured in 3 months.
Slight ptosis & swelling of lids.	Marked congestion & swelling of conj. of upper lids & fornices, with a few pale scattered Trachoma bodies.	-	No definite organisms in discharge.	2% silver nitrate Copper stick.	Fine connective tissue scarring after 3 months.
Marked ptosis & swelling of lids.	Conjunctiva of upper lids dark red, with marked papillary hypertrophy. Conj. of upper fornix in folds. A few pale Trachoma bodies visible.	-	-	10% silver nitrate once. Copper stick.	Improved, commencing TIII after 2 months.
No swelling nor ptosis.	Conj. of both upper lids red and thickened, showing fine streaks of fibrous tissue, with masses of inflamed tissue & scattered granules. Swelling and granulations in upper fornices.	-	-	Copper stick daily.	Progressing cicatrization.
Thickening with blepharitis & matting of eyelashes.	Conj. swollen, dark-red raspberry appearance on upper lids. Yellowish granulations in upper fornices, which protrude in folds.	-	Lachrymal sac involved. Scrofula.	2% silver nitrate daily.	Improved slowly.
Swelling & matting of eyelashes.	Upper fornices project in folds. Marked papillary hypertrophy of upper Conj. Tarsi. Few granulations visible between the papillae.	-	Adenoids etc. Few doubtful Koch-Weeks bacilli	ditto	Discontinued treatment before improving.

No.	Name	Sex	Age	Religion	Complaint	History	Stage
7	Nathu	M.	30	H.	No complaint. Examined because father of No.6.	15 years ago had acute conjunctivitis. Since then no symptoms.	T.III
8	Thakari	F.	50	H.	No complaint. Mother of No.7. Lives with Nos.6 and 7.	No history of eye disease.	T.III.
9	Champa	F.	5	H.	Discharge, pain and swelling.	1 month ago had acute conjunctivitis for 15 days.	T.II.
10	Gulab	M.	25	H.	Half vision in R. eye.	3 months ago had acute conj. R.eye. Unable to open eye for 8 days, when vision had gone. Vision has gradually improved.	T.III
11	Atma Ram	M.	25	H.	Watering of eyes, repeated attacks of inflammation, & diminution of vision.	Duration 2 years.	T.II
12	Makhan	M.	25	O.	Feeling of sand in eyes. Diminution of vision. Photophobia.	Has had repeated attacks of acute conj. during last 5 years. Last attack 4 months ago, when vision was blurred.	T.II.

Condition on Examination			Other Complications	Treatment	Result
Lids	Conjunctiva	Cornea			
Nothing to note.	Line of fibrous tissue above free margin of upper lids, with fine lines radiating & enclosing islands of trachomatous tissue. Fornices swollen, smooth & pale white.	-	-	Copper stick daily.	Discontinued treatment before improving.
Small palpebral orifice. Incurving of lids slight.	Irreg. scarring conj. tarsi, with masses of gelatinous tissue & a few yellow granules. Fornices contracted, white and smooth.	Haziness of upper third - R.eye.	Immature cataract in both eyes.	Copper stick daily.	ditto.
Ptosis. Swelling of lids slight blepharitis.	Great papillary swelling of conj.tarsi - purplish-red in colour. Trachoma bodies mostly covered by papillae. Congestion of bulbar conj. on inner sides.	-	A few Morax-Axenfeld bacilli	2% silver nitrate. Zinc sulphate 1%.	Rapid improvement.
Ptosis & swelling R. upper lid only.	Islands of inflamed conj. bleeding readily, surrounded by lines of fibrous tissue on conj. tarsi of R. upper lid. L. eye similar, less inflamed. Fornices bluish white, with granulations appearing through. Gran. on caruncle R.eye.	.Large oval depression on R, cornea, with facets at upper limbus.	A few gonococci in discharge from R. eye.	2% silver nitrate. Copper stick daily.	After 1 week conj. became paler & less inflamed. Progressive resolution by new fibrous tissue.
Ptosis commencing entropion & trichiasis	Diffuse purplish-red thickening of whole conj. tarsi, with papillary elevations & scattered granulations. Injection of large vessels of bulbar conj.	Whole cornea of both eyes hazy, with pannus more marked in R.	No definite organisms.	2% silver nitrate Copper stick.	Improvement of conj. and corneal condition.
Ptosis. Continual blinking.	Conj. of upper lids and fornices dark-red, swollen & rough, with pale T. bodies. Large vessels on bulbar conj. running on to cornea.	R. irreg. swelling upper limbus. L. Pannus over whole cornea.	Peri-corneal inject. High tension. Glaucoma?	ditto	Discontinued treatment.

No.	Name	Sex	Age	Religion	Complaint	History	Stage
13	Rahmo	F.	40	M.	Watering of eyes and dimness of vision.	For 2 years has had trouble with eyes. Attacks of inflammation. Vision, especially of L. eye, diminishing.	T.III
14	Bantu	M.	10	C.	Redness of eyes and pain.	For 2 years has had attacks of conjunctivitis, improving with treatment.	T.III
15	Chama	F.	50	O.	Watering of eyes and dimness of vision.	Attacks of inflammation every 8-10 days for the last 12 months.	T.III
16	Tulsi	F.	40	H.	Dimness of vision of R. eye.	Up to 3 years ago had repeated attacks of conj. Since then no attacks. 15 days ago vision in R. eye became less.	T.IV.
17	Baso	F.	25	H.	Discharge from eyes and pain.	For last 2-3 years has had severe attacks of conjunctivitis, with pain, swelling of lids, discharge and photophobia.	T.III
18	Gulam Hussain	M.	45	M.	Burning & itching of eyes, & sticking of lids in the morning.	For last 3 months has had these symptoms. Worse after a day's work as ironmonger.	T.II to T.III

Condition on Examination					
Lids	Conjunctiva	Cornea	Other complications	Treatment	Result.
Entropion. Trichiasis. Ptosis.	Conjunctiva of both upper lids & fornices mostly covered with connective tissue. Few calcareous granules & masses of degenerating tissue. Fornices much contracted.	L.cornea covered with diffuse opacity. Pupil obscured.	Immature cataract R. eye.	Trichiasis & entropion operation Ung.Hydrarg.Ox. Flav.	Greatly improved.
Slight ptosis. Thickening of tarsi.	On both upper conj.tarsi there are islands of inflamed red tissue surrounded by fine white cicatricial bands. Also white masses of tissue on bulbar conj.running on to the cornea.	Islands of white tissue at lower limbus in both eyes.	Koch-Weeks bacillus in discharge.	Copper stick daily. Ung. Hydrarg.Ox. Flav	Resolution progressing Cornea cleared, leaving faint leucomata.
Small palpebral fissure. Entropion & commencing trichiasis	Conj.tarsi of both upper lids in thickened and broken into islands by fibrous tissue bands. Some gelatinous patches. Conj. of fornices thickened, with few granulations showing.	Clear	Immature cataract.	Gentle scraping with spoon, followed by copper stick.	T.III advanced.
Ptosis. Redundancy of skin of lids. Slight entropion.	Conj. of lids is smooth & pale, with broad bands of fibrous tissue. Fornices much contracted and pearly white. Injection of bulbar conjunct. in upper half of R. eye.	R.Faint scarring upper limbus, with injected vessels. L.Leucoma.	Cataract R. eye	Ung.H.O.P.	R. Trachoma is cured.
Trichiasis, entropion & thickening of tarsus.	Conj. of upper lids purplish-red, with rough masses of gelatinous tissue. Fornices smooth & blüish-white. Bulbar conj. of R. eye injected.	R.eye thick pannus. L.eye small facets.	R.pupil obscured.	2% silver nitrate. Copper stick.	Improved.
Early trichiasis.	Conj. of upper lids is dark red, with numerous pale round Trachoma granules. Conj.of fornices is paler & shows no granules.	R.eye old pannus at upper limbus & active pannus at lower.	R. eye immature cataract.	Expression followed by copper stick.	Soon passed into T.III.

No.	Name	Sex	Age	Religion	Complaint	History	Stage.
19	Vidia Vati.	F.	5	H.	Discharge & gumming of lids in the morning.	Eyes have discharged off & on since she was 2 months old. No attack of acute Conjunctivitis.	T. II
20	Sawan	F.	7	O.	Pain & swelling & discharge especially in R. eye.	Acute symptoms for last 3 days. Previously had slight discharge	T.II
21	Daulat Ram	M.	80	H.	Redness and watering of eyes and diminished vision.	During last 8 years has had repeated attacks with these symptoms.	T.III
22	Mandah	M.	40	M.	Irritation from eyelashes rubbing eyes.	No history of eye-trouble till irritation from eyelashes started a few days ago.	T.III
23	Gendi	F.	25	H.	Burning of eyes and sticky discharge in the morning.	For last 6 years in hot weather has had attacks of acute conj. lasting about 15 days.	T.III
24	Khansi	M.	36	H.	Increasing diminution of vision for last 8 days, and watery discharge of R. eye.	L. eye destroyed 12 years ago after acute inflamation. R. eye Feeling of grit in eye for last year.	T.III

Condition on Examination Lids	Conjunctiva	Cornea	Other Complaints	Treatment	Result.
Ptosis & thickening of L. upper lid.	Great papillary thickening of conj. of L. upper lid (raspberry appearance) Fornix thrown into folds. No distinct T granulations visible. R. eye similar, less marked.	Pannus upper $\frac{1}{4}$ m L. cornea with dilated vessels.	-	2% Silver Nitrate	Papillary enlarg. gradually diminished Granulations appeared.
Slight swelling & ptosis	Great swelling & redness of conj. of upper and lower lids with discrete granulations and papillary hypertrophy. Bulbar conj. much infected.	Circular pannus round R. cornea (Pannus Scrofulosus)	Small phlyctenular ulcers. R. eye Koch-Week's bacillus.	2% Silver Nitrate	Acute symptoms rapidly disappeared
Ptosis Entropion ~~Fuchissis~~ *trichiasis*	Marked inflam. and hypertrophy of conj. of both lids of L. eye. Bands of connective tissue enclosing red & inflamed areas in the upper lid R. eye. Fornix contracted.	R. eye. Small pannus & old leucoma	L. eye shows an exacerbation due to superadded infection	2% Silver Nitrate L. eye Copper Stick.	Rapid improvement in L. eye.
Ptosis Entropion. Early ~~Fuchiasis~~ *trichiasis*.	Upper fornices markedly contracted. Large vessels running down from fornices on to lids. Evidence of scarring with some fleshy masses on the upper lids. Injection of bulbar conj. & circum corneal. inj. of R. eye.	R. eye fleshy pannus upper $\frac{1}{3}$ & opacity at lower limbus.	-	Operation for entropion & trichiasis 2% Nitrate Ung. H.O.F.	Pannus almost disappeared Became advanced T. III
Slight heaviness of lids.	Upper fornices somewhat contracted, bluish white & smooth. Thick irregular bands of connective tissue on upper lids enclosing islands of hypertrophied tissue. Resolution more advanced in L. eye.	-	-	2% Silver Nitrate Copper Stick daily.	Improved
R. eye marked ptosis infiltration of tarsus & commencing entropion.	R. eye Fornix much contracted. Upper conj. tarsi is hypertrophied dark red in colour with pale gelatinous areas & irregular calcareous-looking bodies, size of large pin's head. Marked inj. of bulbar conj.	R. cornea almost completely covered with dark grey pannus. Pupil not visible.	Phthisis bulbi L. eye.	Sub. conjunctival inject. of 1 in 4,000 cyanide of mercury	Pannus resolved except at upper limbus. Pupil visible. Conj. of upper lid smaller & paler.

No.	Name	Sex	Age	Religion	Complaint	History	Stage
25	Mool Chand	M.	35	H.	Watering of eyes and interference with vision.	8 years ago had an attack of conjunctivitis. Since then recurrent attacks in hot weather.	T.III
26	Ali Husain	M.	54	M.	Redness of eyes, watering and photophobia.	3 years ago first had trouble with eyes, conjunctivitis lasting 1 week. Several attacks since. Last one did not clear up.	T.III
28	Ragbir Sarun	M.	10	H.	Watering of eyes and redness.	No history of eye trouble until 6 days ago.	Early T.II
27	Mula Singh	F.	24	H.	Photophobia in sunlight. Redness of eyes. Interference with vision.	Duration 2 years.	T.III
29	Mula Vati	F.	4	H.	History: Sister of Case 28. 6 months ago had conjunctivitis & repeated attacks of inflammation since then.	Complaint: Redness and watering of eyes and photophobia.	T.II
30	Shankar	M.	35	H.	Weakness of vision. Watering & swelling of e yes.	8 years ago had acute conjunctivitis. 3 years ago present symptoms came on & have continued.	T.III

	Condition on Examination			Other Complications	Treatment.	Result.
	Lids	Conjunctiva	Cornea			
	Slight thickening of lids.	R.Eye:Upper fornix pale & contracted.Upper conj. tarsi shows pale gelatinous masses & connective tissue bands. L,Eye:Upper conj.tarsi has dark-red mottled appearance,with gran.	L.Eye: fine vessels running on to upper part of cornea.	-	Gentle scraping with spoon followed by 1% Liq. Hydrarg. Perchlor.	Increase in conn.tissue. Advanced T.III.
26	Ptosis, Blepharospasm. Entropion.	visible & less con.tissue. Conj.ofupper & lower lids has dark-red mottled appearance,with papillary elevations & gelatinous areas surrounded by conn. tissue,which is dimly visible,due to superadded inflammation.	Thick fleshy pannus upper third both corneae, with large vessels running on to it.	Superadded conj. due to Koch-Weeks bacillus.	Atropin 2% silver nitrate Ung.H.O.F.	General congestion much reduced. Pannus much thinner.
8	-	Congestion of conj. of upper lids & fornices, with a few small pale gran. near the upper border of the tarsus and in the fornices a slight papillary hypertrophy.	-	-	2% silver nitrate & copper stick.	Passed through T.III to T.IV in 10 weeks.
	Ptosis & thickening of tarsi.	Marked thickening & congestion of conj.of the lids,with faint white lines visible. Fornices thrown into folds.Condition is T.III with a superadded infection. Large vessels run down on to cornea of R.eye.	R.Eye: ground glass appearance, with small facets & large vessels. L.Eye:opacity over pupil.	-	2% silver nitrate. Later copper stick.	Improved to advanced T.III.
	Heaviness of lids	The Conj. of the lids is swollen & congested with a few pale granulations visible. The Conj. of the fornices is much swollen with a red fleshy appearance	R. Eye: Fine circumcorneal injection & diffuse haziness of whole cornea	—	2% Silver nitrate & Ung. H.O.F.	Cornea cleared up after 3 weeks. Commencing T III after 1 month.
	Ptosis Thickening of lids Entropion & early trichiasis	Upper Conj. tarsi shows advanced Cicatrization with islands of Trachomatous tissue. Fornices are smooth & much contracted Injection of bulbar Conj. with vessels running on to the cornea	Irregular opacities & vascularization of areas of both Corneae	vision fair	Operation for entropion & trichiasis Ung. H.O.F.	Corneal opacities became facette Vision improved T. IV

No.	Name	Sex.	Age	Religion	Complaint.	History.	Stage.
31	Rahminan	F.	40.	M	Watering of eyes & irritation	For 15 years off & on has had these symptoms with occasional exacerbations.	TIII.
32	Ramzan.	M	12.	M	Dimness of vision & photophobia.	A year ago eyes were painful & swollen & discharged for 5 days.	TII.
33.	Puran	F.	20.	H.	Watering of eyes; dimness of vision; severe frontal headaches.	1½ years ago had acute conjunctivitis. Since then has had trouble off &on.	TII to TIII.
34.	Sharifan.	F.	15.	M.	Photophobia. Watering of eyes & dimness of vision for last 8 days.	For some years past in early summer has had attacks of acute conj. lasting 7 to 10 days.	TII.
35.	Rada.	F.	8.	H.	Phtophobia & sticky discharge.	Duration 10 days.	TII.

Condition of Examination.			Other		
Lids	Conjunction	Cornea	Complications.	Treatment.	Result.
Ptosis swelling of lids. Entropion & trichiasis.	R. Eye. Irregular areas of swollen & congested tissue surrounded by connective tissues; also some gelatinous patches & a few yellow granulations. L. Eye. Resolut. more advanced.	Outer 1/3 L.cornea shows superfic. ulcer caused by rubbing of lashes.		Operation for Entropion & trichiasis Copper stick.	Symptoms cured. Became advanced T III.
Ptosis & blepharospasm.	Conj. of lids is swollen & congested with marked papillary hypertrophied & small granulations on upper lid. Fornices hypertrophied & project in thick folds. Bulbar conj. infected.	Complete haziness of both corneae. More marked in the eye.		Grady's forceps followed by Copper stick & H O F Ung.	Corneae cleared. Passed into T III after 1 month.
Ptosis & marked thickening of tarsi.	Conj. of upper lids is hypertrophied with colour of raw meat and velvety. Some irregular protuberances. Some contraction of upper fornices. Injection of bulbar conj. & faint circum-corneal injec.	L.eye ground-glass appearance with vessels running on at upper adge. R.eye commencing pannus.		2% Silver nitrate. Copper stick.	Faint cicatric. bands appeared after 3 weeks.
Blepharospasm.	Large irregular gelatinous masses & great papillary hypertrophy of conj. of both upper lids. Fornices greatly swollen. Irregular network of injected vessels in bulbar conj.	Pannus upper ½ both corneae. Irregular faceting lower ½ L.cornea.	Iritis in L. eye.	10% Silver nitrate applied once; then copper stick.	Discontinued treatment.
Swelling of lids	Conj. of both lids hypertrophied with rows of pale granulations standing out. Granulations in upper fornices have pedunculated appearance.	clear.		2% Silver nitrate; copper stick.	Early T III after 4 weeks.

No.	Name.	Sex.	Age.	Religion.	Complaint.	History.	Stage.
36.	Daniel	M.	32.	C.	Redness of eyes. Feeling of grit & sticky discharge.	Duration 5 months.	T II.
37.	Beatrice.	F.	2½.	C.	Redness & swelling of eyes: child cries with pain.	Daughter of (36). Ten months ago eyes became inflamed; have discharged since.	T. II.
38.	Khan Mshani	F	40.	H.	Diminution of vision: cannot recognise people.	7 years ago acute conj. lasting 2 months, when sight first became diminshed.	T. III.
39.	Chhots.	F	30	H.	Irritation of eyes causing constant rubbing & discharge.	Has had recurrent attacks of conjunctivitis for last 2 years.	T II
40.	Ran Dao.	M.	36.	H.	Photophobia & watering of eyes.	For 10 years has had trouble with eyes, at first occasionally, now almost constant	T III

	Condition on Examination					
	Lids	Conjunctiva	Cornea	Other Complications	Treatment	Result
36	Swelling of the lids and ptosis.	Conjunctiva of both upper & lower lids has a uniform fleshy appearance, with small scattered greyish-white granulations. Great redundancy of the conj. in the fornices.	-	-	½% silver nitrate. Copper stick.	Diminution of hypertrophy. Early T.III after 6 weeks.
37	Swelling of the lids.	Conj. of both lids and fornices is swollen, and congested with numerous typical sage-green granulations.	-	-	Expression & 10% silver nitrate once.	T.III commencing after 6 weeks.
38	Trichiasis and Entropion.	Eyelashes in both eyes sweep cornea. Conj. of upper lids is red and hypertrophied, with connective tissue bands. Bulbar conj. injected.	R.Eye: cornea facetted & opaque. L.Eye: diffuse corneal opacity.	L.Eye: Prolapse of iris.	Operat. for Trichiasis & entropion. Ung.H.O.F.	Irritation reduced. Vision improved after 3 weeks.
39	Ptosis & swelling of lids.	Upper fornices of both eyes protrude in large folds & show numerous granulations. Conj. of upper lids is hypertrophied & has a velvety appearance, with granulations showing.	-	-	Excision of upper fornices. Later copper stick.	Resolution progressed well.
40	Blepharospasm, entropion & trichiasis.	Upper fornices almost gone. Conj. of upper lids is red & congested, with pale, gelatinous areas & a few discrete granulations. Injection of large vessels of bulbar conj. & circumcorneal injection.	R.Eye: Upper half cloudy opacity. L.Eye: Irregular diffuse opacity.		Operat. for entropion and trichiasis. Ung. H.O.F.	Irritation removed. Vision improved.

No.	Name	Sex	Age	Religion	Complaint	History	Stage
41	Gulam Rasul	M.	60	M.	Dryness and burning of eyes and diminution of vision.	For last few years these symptoms have been getting worse. Before this, had chronic inflammation.	T.IV
42	Moti	F.	25	O.	Pain, irritation, watering of L. Eye, & diminution of vision.	Chronic irritation of eyes last 5 years. 3 months ago an acute attack of conjunctivitis.	T.III.
43	Ramzan	M.	16	M.	Watering of eyes and slight discomfort.	Has had 3 or 4 attacks of mild conjunctivitis during last year.	T.II
44	Ram Dus	M.	50	H.	Blind in L. Eye	No history of conjunctivitis. Occasional discharge from eyes.	T.III
45	Abdul Rahman	M.	40	M.	Burning and watering of eyes & feeling of grit.	Has had these symptoms for last 2 years, worse for the last 3 months.	T.II

Condition on Examination			Other Complications.	Treatment	Result
Lids	Conjunctiva	Cornea			
Contracted palpebral aperture. Entropion of lower lids.	Marked contraction of conj. of fornices, which goes from the lid direct on to bulb. Conj. is pale & atrophied, and resembles epidermis. Few large injected vessels on bulbar conj.	Thickened, with a dull lustreless appearance	Destruction of lachrymal ducts. No flow of tears.	Castor oil drops.	No improvement.
Entropion and trichiasis.	Conj. of upper lids has a dark-red florid appearance, with great papillary swelling. Fornices somewhat contracted. Circumcorneal injection, & large injected vessels in bulbar conj. L.Eye.	L.Eye: corneal ulcer at inner limbus.	Iritis L.Eye. Prolapse of iris & commencing staphyloma.	Operat. for trichiasis & entropion. Atropin.	Ulcer healed. Dense leucoma.
Slight heaviness of the lids.	The conj. of the upper lids is red & swollen, with numerous discrete granulations also on the upper fornices and papillary hypertrophy.	-	-	Excision of upper fornices. Copper stick.	T.III after 3 weeks.
Slight ptosis.	The conj. of the upper lids is somewhat thickened, with faint cicatricial lines showing. Fornices are smooth and pale.	-	Mature cataract L,Eye.	2% silver nitrate 1 week. Extract. of cataract.	No complications Good result.
Ptosis, thickening of lids, brawny feeling & trichiasis	Conj. of upper lids is swollen, dark-red in colour, with numerous pale, discrete granulations. Conj. of fornices protrudes in folds & shows numerous granulations.	Commencing pannus in R.cornea.	-	Expression, followed by copper stick.	Passed into T.III after 3 weeks.

No.	Name	Sex	Age	Religion	Complaint	History	Stage
46	Ganga Devi	F.	55	H.	Blind in R.eye. Dimness of vision in L.eye. Dryness of eyes.	R.eye has gradually become blind. Last 5 years no conjunctivitis. Previous to that had repeated attacks.	T.IV
47	Chhotu	M.	54	O.	Blind in both eyes & watering from the eyes.	Chronic irritation of eyes for some years. Gradually became blind.	T.III
48	Parbati	F.	35	H.	Watering of eyes & feeling of sand in eyes.	Recurrent attacks of mild inflammation.	T.III
49	Krishan Das	M.	25	H.	Unable to open eyes. Intense pain & purulent discharge.	Acute attack started 3 days ago.	T.II
50	Faquira	F.	55	M.	No vision in either eye.	Progressive loss of vision for last 2 years. No definite history of conjunctivitis.	T.IV.

Abbreviations

Religion H. = Hindu
M. = Mahomedan
C = Christian
O = Outcaste.

Treatment Ung. H.O.F = Ung. Hydrargyri Oxidi Flavi 5-grs to 1 ounce

Stage T = Trachoma.

Condition on Examination			Other Complications.	Treatment	Result
Lids	Conjunctiva	Cornea			
Commencing entropion of both upper lids. Narrowing of palpebral fissure.	Conj. of upper lids is pale & smooth, with white lines of connective tissue visible. The conj. fornix is pale & much contracted. The semilunar fold & caruncle have been replaced by fibrous tissue.	-	Mature cataract in R, eye. Immature in left.	Extraction of cataract R.eye.	Good vision in R.eye.
Entropion and trichiasis.	Areas of hypertrophied & gelatinous tissue in upper lids, with broad bands of connective tissue. Fornices smooth and contracted.	Faint opacity upper part of L, cornea.	Cataract in both eyes.	Operat. for trichiasis & entropion, followed by extraction of cataract.	R.eye good result. L.eye opacity became denser.
Ptosis & thickening of tarsi.	Islands of trachomatous tissue and calcareous granulations on upper lids. Upper fornices somewhat contracted.	-	-	Gentle curettage. 1% Liquor Hydrarg. Perchlor.	Cicatrization progressed well.
Eyelids red and swollen & kept shut.	Marked injection of all the conj. of both eyes. Conj. of lids is greatly swollen & bleeds readily. It has a velvety appearance. No granulations visible. Subconj. haemorrhage.	Pannus & infiltrat. of upper half of R.cornea.	Koch-Weeks bacillus in discharge.	2% silver nitrate.	Rapid improvement of acute symptoms. Few granulations appeared.
Slight diminution of palpebral fissure.	Conj. of lids is pale & smooth, showing white cicatricial bands. Upper fornices are pale and contracted.	Small facets upper limbus L.cornea.	Mature cataract in both eyes.	Extraction of cataract.	No complications. Good result.

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Specimen of Case Sheet-

TRACHOMA CASES, JAGADHRI MISSION HOSPITAL.

Number.	Name.	Sex.	Age.	Caste.	Date.

Complaint

History

EXAMINATION OF PRESENT CONDITION.

General Appearance

	R. Eye.	L. Eye.
Lids		
Conj. Palpebral Up & Fornical		
Conj. ,, Low		
Conj. Ocular		
Cornea		
Other Complications		

Treatment and Course.	